SCIENTIFIC AMERICAN

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New Mechanical Inventions.

A new form of Rock Drill, of the reciprocating type, has been designed by Mr. C. H. Chandler, of Foxcroft, Me. The drill point is cruciform in transverse section, having three of the wings or blades sharpened on the lower edges, and one wing squared and a little shorter than the others, the object being to crush the drill chips, keep the bottom of the hole free, and prevent the drill from entering too deeply into soft rock.

Mr. E. O. Leermo, of Gold Hill, Nev., proposes to make the Suction Pipes of mining pumps terminate in perforated nozzles attached by a ball and socket joint, so as to be readily removed out of the way of the workmen in sinking the shaft, and to be used in shallower water than a straight and rigid suction pipe can be.

A new Screw Propeller, which is claimed by the inventor, Mr. J. C. Capern, of New York city, to be unusually economical of power, has its blades formed in the section of a hollow semi-cone, having the flaring sides astern.

A machine for Cleaning and Condensing Lint Cotton as it comes from the gin has been invented by Mr. A. T. Hunt, of Arkadelphia, Ark. It consists of an inclined stationary or adjustable screen, made in sections, with parallel fingers, in connection with an endless belt having lateral combs or rakes.

Mr. W. F. Eyster, of Chambersburg, Pa., has invented an improved Water Motor for driving light machinery. The class of motors to which this invention belongs is that which employs a wheel having buckets upon its periphery, against which the stream of water is made to impinge. The improvements consist in the peculiar construction of the wheel, which is made of two convex disks with a trough-shaped periphery, carrying two rows of buckets; in the construction of the case, which is divided horizontally and arranged so as to be readily taken apart, and in the devices for preventing leakage at the joints.

Mr. Caspar Hüebner, of Newark, N. J., has invented an improved Motor, applicable for purposes of locomotion, such as propelling a hand car, and arranged so as to give out for a long time power which is stored up in heavy fly wheels. Motion is communicated to the fly wheels by means of cranks oppositely arranged and operated by hand levers.

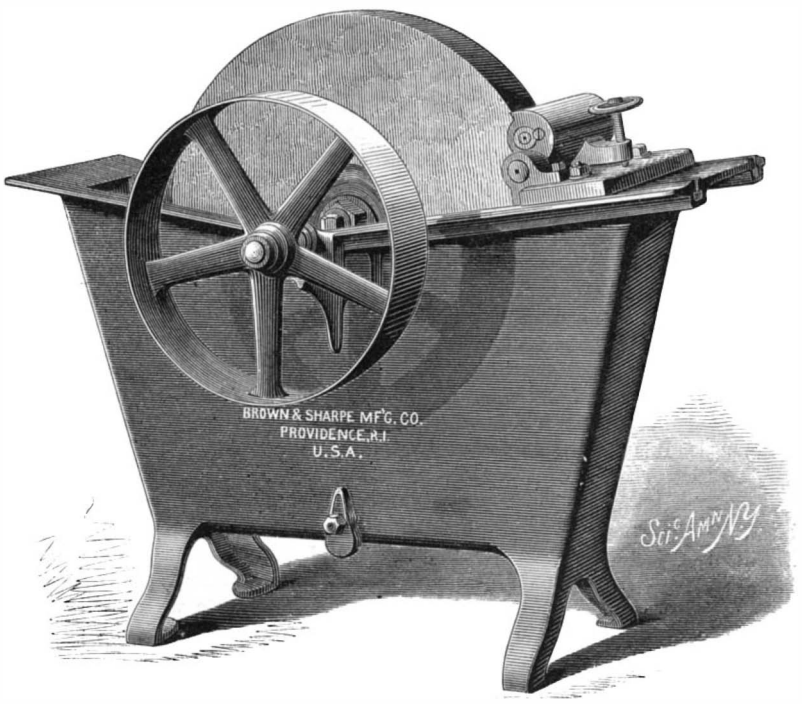

Fig. 1.—IMPROVED GRINDSTONE TROUGH.

An ingenious Hoisting Clamp for Barrels has been invented by Mr. W. Bulkeley, of Ballston Spa, N. Y. Two pairs of pivoted levers are connected at their lower ends by semicircular cross bars, and at their upper ends to a straight cross bar by links, the strain of the hoisting rope having the effect of tightening the hold upon the barrel in proportion to the weight of the latter.

IMPROVED MACHINE TOOLS.

In the annexed engravings we illustrate some new machine tools manufactured by the Brown & Sharpe Manufacturing Company, of Providence, R. I., all of which are noteworthy for excellence of design, finish, durability, and general efficiency. In Fig. 1 is shown a grindstone trough combining a number of very desirable qualities. In addition to the ordinary arrangement of trough, spindle, and pulley, it is provided with self-oiling journal boxes and an adjustable device for truing the grindstone. This device, shown in Fig. 4, page 274, can be instantly applied to the face of the stone, working automatically and without dust, keeping the stone always in good shape and condition without interfering with its constant use. The stone should be revolved so as to have the device upon the face which moves upward. The main stand or bottom piece of the device is securely clamped upon the trough close to the face of the grindstone, then by turning the hand wheel the threaded roll is brought into contact with the face of the stone and allowed to remain so as long as is requisite to produce the desired result. The water is left in the trough as usual, so that the device, while always at hand and in position, does not for an instant stop the continuous use of the stone. When the hardened steel threaded roll becomes worn it may be readily and repeatedly cut from time to time as occasion may require.

In Fig. 2 is shown a special automatic bevel and spur gear cutting machine, in which there are two separate heads upon one bed or frame. One of them is designed for cutting bevel, and the other spur gear, teeth. They are specially intended for cutting the small gears used upon sewing machines and other light machinery. Both machines are automatic in their movements to the extent of revolving, the wheels being cut from tooth to tooth, the cutter passing through for each tooth, and stopping when the wheels are completed.

Upon the machine for bevel wheels the movement of a lever places the wheel in position for the second cut, after

[*Continued on page* 274.]

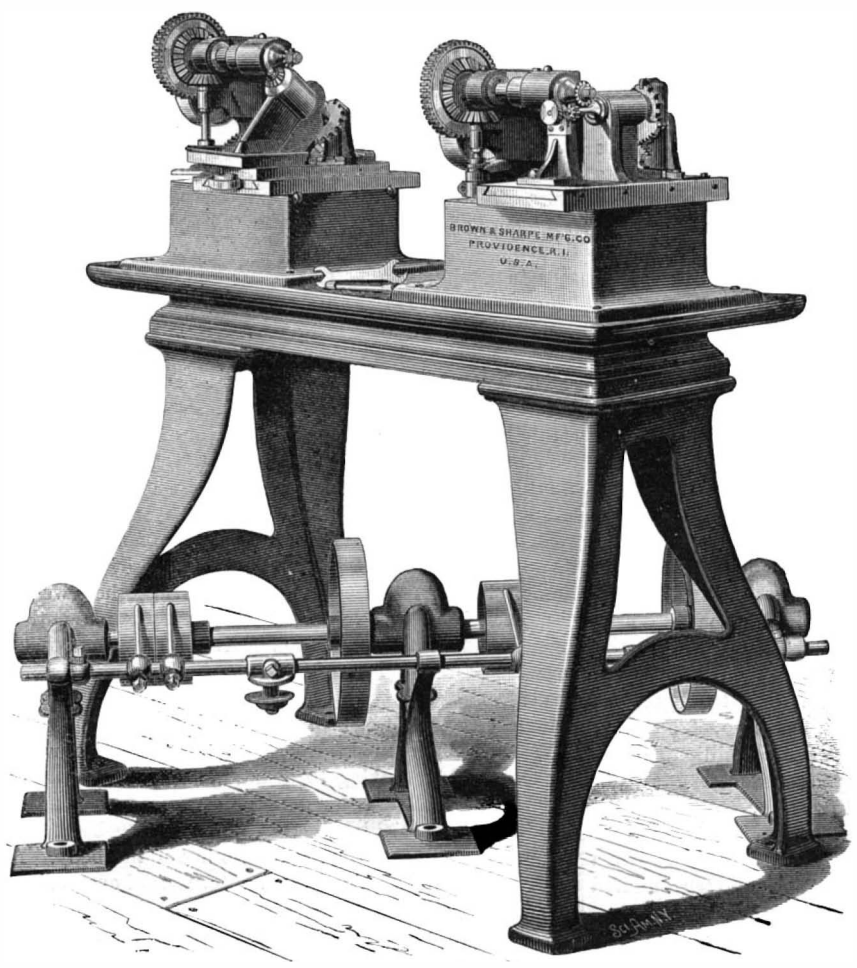

Fig. 2.—BEVEL AND SPUR GEAR CUTTING MACHINE.

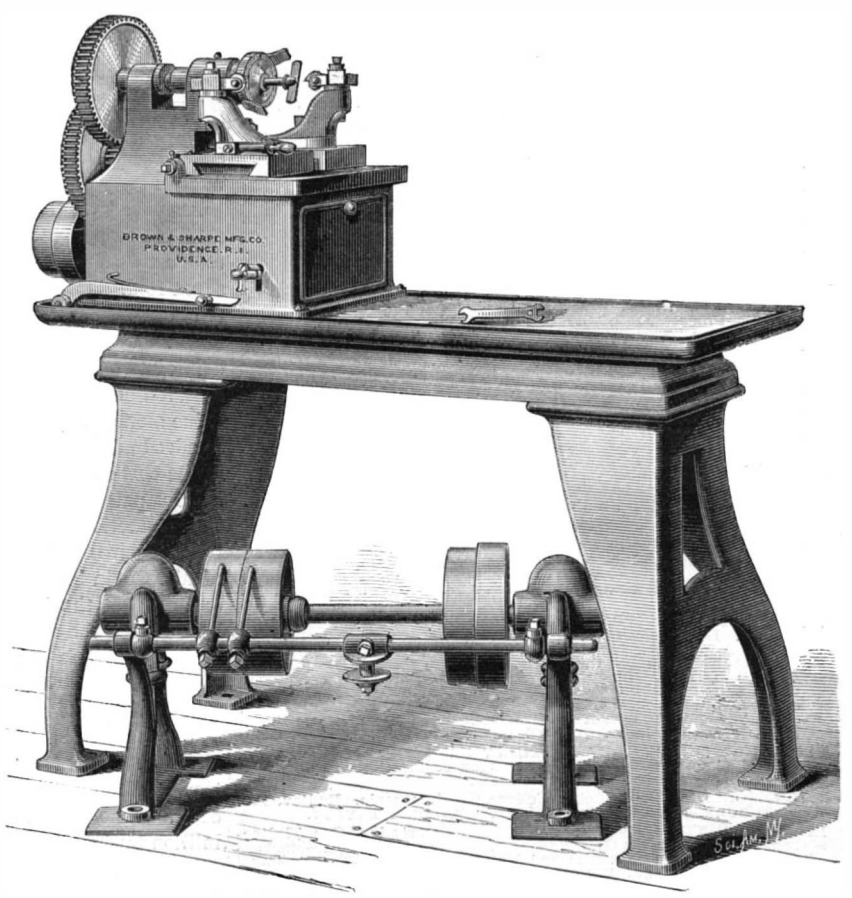

Fig. 3.—AUTOMATIC BALANCE WHEEL TURNING MACHINE.

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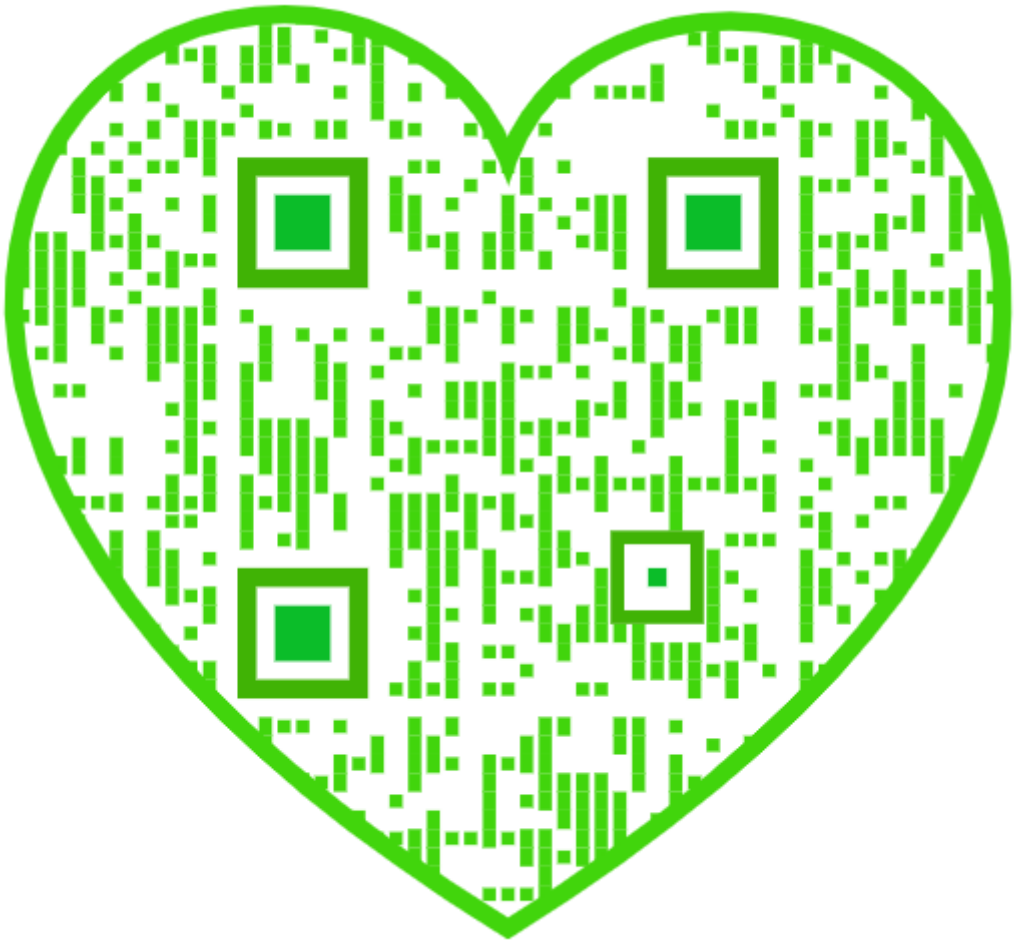

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HOW PATENTS AFFECT PRICES.

Give a dog a bad name—then hang him!

This is substantially the logic of no inconsiderable part of the world with regard to inventors' rights. A patent is called a tax upon the consumer, a tribute to greedy corporations, a burden upon the industry of the country; and the cry, "Away with patents!" follows as a matter of course.

A prominent speaker before the House Committee on Patents (Hon. S. A. Hurlbut) echoed, perhaps unconsciously, this estimate of the system, when he parodied Sydney Smith's description of the taxation of the English people from the cradle to the grave. "It is so in the United States in regard to patents," said the speaker. "I am told that there are patented apparatuses used sometimes during the birth process; but after the birth and until the death, there is not a step in the existence of that child, from the time that by patent pins his clothing is hooked together up to the time you carry him to his grave, an old man, in a patented coffin and in a patented hearse, that he can escape the operations of the Patent Office. They have gone so far now that his body is lowered into the ground by a patent crank, and even his grave stone is made by a patent process." Another speaker, the attorney of the Western Railroad Association, was even more severe in his protest against tribute-taking patents. Even so simple and necessary a thing as a loaf of bread, he said, "pays tribute to twenty-one classes of patents, in each of which classes many patents are now alive: the plowshare, point, handles, and tackle; the harrower, the seed sower, the cultivator, the harvester, the thrasher, and the separator; the bolts, the hopper, the stones, and the gearing of the mill; the bag, the holder of the bag, and the strap or string with which it is tied; the yeast or baking powder, the oven, the extension table, and the dishes, are each the subjects of patents to which tribute is paid."

The inference from all this is that the bread we eat costs more than it otherwise would by its share of each and all of these various tributes; that each step of our lives from the cradle to the grave is increased in difficulty and cost by the aggregate of all the burdens laid upon it by the infinite number of patents which hedge it about.

It is quite possible that the talk of the gentleman quoted was sheer buncombe; but the view indicated is seriously held by not a few honest people. For their sake let us examine the immediate effects of some of the patents complained of. Take those bearing upon the loaf of bread. The farmer's plow is patented. We may assume that a certainty; for if it were not patented he could not hope to compete with his neighbors who use patented plows. Space would fail here to trace the successive patented improvements in plows, by which the cost of plowing has been reduced. One of the latest, the substitution of chilled iron for cast steel in the mould-board, has doubled the durability of plows, and at the same time reduced their price from fifteen to twenty per cent. Within twenty years the improvement in lines of draught in plows, patented improvement, has reduced the cost of plowing at least one half. With over a hundred million acres of land under plow, the annual saving to the country effected by plow-patents must be counted by millions, and the cost of bread is proportionately diminished.

The loaf of bread "pays tribute" also to seeders, on which about six hundred patents have been issued. One effect of these machines is a uniformity and certainty in sowing, at a depth necessary to prevent winter killing in winter wheat, by which the crop is increased from one eighth to one fourth. The lowest proportion of gain for the crop of winter wheat of last year would amount to about 40,000,000 bushels; and it would have been impossible to produce the crop raised without the seeders. The simple fact that 800,000 seeders have been made during the past twenty years is proof enough that farmers find them profitable. Thanks to patents the seeders have been greatly improved in that time, and at the same time the price to farmers has been reduced fifty per cent.

Another "tribute" is paid to reapers and harvesters. The simplest reaper was the sickle. By the invention of the cradle a man's daily work in the grain field was increased seven-fold. With it a man could cut an acre and a half in ten hours, while two helpers could rake, bind, and stack the straw. Now with the combined reaper and binder a boy driving two horses can accomplish from ten to twelve times as much harvesting in the same number of hours. This machine alone has proved its capacity to save the country a hundred million dollars a year, with a proportional reduction in the cost of bread. And of like effect have been the numerous patents in each and all of the twenty-one stages in the production of the loaf.

The figures we have given are drawn from the argument of Mr. Coffin before the committee referred to. He goes on to show that the invention of a single improved cultivator has reduced the cost of raising corn from 2 to 3½ cents a bushel. At this rate the saving on the crop of last year would range between twenty-five and fifty million dollars. By the old process of hand shelling the sheller got one tenth of the corn, and a man could shell from five to six bushels in a day. Now two men with a patent sheller will shell fifteen hundred bushels a day, and the regular charge is half a cent a bushel. The saving on a crop of thirteen hundred million bushels can be easily calculated.

The owner of an invention for making horse-shoes "taxes" the public to the extent of selling shoes at the market price of horse-shoe iron. He has a large establishment for making the iron, and by converting it into shoes is able to keep his mills in operation at a small profit to himself, when otherwise they would have to remain idle, owing to the depressed condition of the general iron market. The regular saving in the cost of shoeing horses effected by the invention of horse shoe machines is twenty-five cents for each set of shoes. The general use of machine-made shoes in this country would reduce the aggregate cost of horse-shoeing from twelve to fifteen million dollars a year. In like manner patented machines for making horse-shoe nails are a "burden" to the blacksmiths to the extent of furnishing from two to three pounds of nails for the price required for one pound of hand-made nails. A machine for finishing carriage shafts has reduced this part of their cost from eighteen dollars to seventy-five cents, and thus enables the owners of the patent to send their shafts to England, Germany, and Australia, and yet compete successfully with the cheaper hand labor of those countries. A patented knitting machine (American), costing two hundred dollars, knits stockings at the rate of one sixth of a mill per pair for attendance, or sixty pairs for a cent. American patented looms have so reduced the cost of cloth making that our muslins and calicoes can be sold at the doors of English and other foreign mills cheaper than they can be manufactured there.

Thanks to patented machines, eighty-five per cent of the labor of making shoes is now done by machinery. A hundred million pairs were made on one class of machines last year. Labor is better paid than before the machines were introduced, much more is employed, the quality of the work is increased fully twenty-five per cent, and the cost of stock has advanced, yet, as Mr. Hyde pointed out, the price of shoes has been very greatly reduced, so much so that American shoes are finding sale the world over. The royalties on all the machines used in the best equipped factories, Mr. Storrow was told by a large manufacturer, are less than would be the rent on the additional room which would be required to do the work by hand!

The manufacture of saws in this country has had to "pay tribute" to something like two thousand patents. At present nearly every process in this line of manufacturing is covered by a patent. Operatives are paid one third more than fifteen years ago, while their productive capacity has been increased, by patented processes, five-fold. As a consequence saws have been so cheapened as not only to almost entirely supersede those of foreign make at home, but to make possible a large export business to England, France, and all over the civilized world.

One of the most profitable patents of late years was that on the Bessemer process of steel making, a process which reduced the cost of a ton of steel from $200 to $55. The highest royalty charged by Mr. Bessemer was $5 a ton, or a little over three per cent of the saving due to the process. The royalties on the machines which revolutionized the manufactory of hosiery and other knitted goods in England, did not exceed three per cent of the savings they effected. The aggregate royalties on the numerous machines used in shoe making are still less—3¼ cents per pair upon fine sewed work, and about 2 cents per pair on pegged work.

We have seen what enormous gains and savings have come to the country through a few agricultural inventions. The successful machines have paid their inventors handsomely; but their gains have been as nothing compared with those that have accrued to the users of the machines. And the same may be said of all successful patents. The public is the chief beneficiary. It is not possible for a patent to raise the price of anything. Its sole advantage to the holder consists either in enabling him to offer an entirely new and useful product to the world, as the Goodyear rubber patent, or in enabling him to furnish a better article at a given price or a standard article at a lower price than his competitors can with profit. In either case the public gains more or less during the life of the patent, and ultimately the entire profit of the improvement which the patent covers. The possibility of the alleged tribute taking hinges entirely on the assumption that the progress of invention would be the same in the absence of patents—an assumption which not only has no evidence to support it, but which all experience refutes.

WHAT IS LIFE?

The best our dictionaries can give in answer to this question is the verbal definition of the French encyclopedia, "Life is the opposite of death," a form of words giving no clew to the nature of the phenomena, the aggregate of which we call life. Language has many pairs of similarly contrasted words, such as up and down, high and low, hot and cold, heavy and light; and to say that any one of these is not its opposite adds nothing to the definiteness of our conception of either. Are life and death, like the others we have cited, merely relative terms? Or is there such an entity as Life, the addition of which to not living matter makes it living; the subtraction of which from living matter makes it dead? Is life the result of organization, or is organization primarily the result of life? What *is* life?

When primitive man asleep in his hut dreamed of war and the chase, of journeying to distant places, conversing with the dead, and the like, his natural inference was that there was in him a special self which left the sleeping body at will, yet was forced to return on the waking of the body. And since he saw in dreamland the counterparts of everything he saw in waking life, he as naturally extended to all objects, dead as well as living, the double existence he imagined for himself.

Accordingly from the very dawn of history the conception of life as something supernatural, something superior to the

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bodily organization, which left the body temporarily in sleep and trance and the stupor of drunkenness or disease, and permanently on dying, has been familiar to all thinkers. The idea of life as the result or expression of material combination came much later. Later still came the compound theory of life held by Leibnitz and Descartes and their followers, who believed in a physical life for the body and a purely spiritual life for the mind. From this point of view the body is a machine, made up of mechanical devices and operated by mechanical or purely physical powers, while it is inhabited by a soul which thinks, but takes no part in the discharge of vital functions. In the words of Leibnitz, "The body goes on in its development mechanically, and the laws of mechanics are never transgressed in its natural motions; in the soul everything takes place as though there were no body, and in the body everything takes place as though there were no soul." This view makes life the product or expression of material combinations up to the point of consciousness; above that the soul is the life.

Of the three theories, the purely spiritualistic—that is, that life is due to the indwelling presence of spirit—is at once the oldest and still the most popular. This was the conception of Pythagoras, Plato, Aristotle, and Hippocrates. It has always been the theory of the Christian Church; and it underwent many vagaries at the hands of Christian mysteries, scholastics, alchemists, and other speculative writers during the Middle Ages. At one time it was believed that each and every vital process was the work of a particular spirit, and a man's comfort and character depended on the kind of spirits that pervaded and animated him. Such were the teachings of Basil, Valentin, Paracelsus, and Van Helmont. Stahl summarily dismissed all this infinite host of immaterial intelligent governing spirits save one, the rational immortal soul. This soul, in his view, was the very principle of life. There had grown up in that day a school of chemist-doctors who resolved all the phenomena of life into chemical action. In opposition to those Stahl contended that the real life force was not only unlike the chemical force of ordinary matter, but that the two kinds of force were hostile to each other—life persisting only so long as the vital or soul force was dominant, death being the ultimate victory of the physical forces.

Stahl's immediate successors were soon compelled to reject the idea that vital force was an intelligent force; intelligence was relegated to the soul; but they retained the notion of antagonism between vitality and the laws of mechanics, physics, and chemistry. From this point of view Bichat defined life as "The group of functions which resist death."

This idea of absolute diversity between the laws of living bodies and those which appear in "dead" matter is still a very prevalent one; but advancing science has shown it to be unfounded in reality. If it were true that in living bodies the physical and vital properties and processes are in constant and direct antagonism; or, as Bichat has said, "the physical properties fettered by the vital properties are perpetually checked in the phenomena they would tend to produce," then the intenser the life of any organism the weaker and slower should be the purely physico-chemical operations going on within it. But the exact contrary is the rule. Whatever restrains or lessens the organic processes directly diminishes vital activity; on the contrary, the more active the life the more rapid are the material changes in the organism. In the words of Claude Bernard, the alleged opposition, antagonism, or conflict between vital phenomena and physico-chemical phenomena is an error which the discoveries of modern physics and chemistry have thoroughly exploded. Life works in harmony with the other forces. Is it like them, or entirely different?

Obviously the real nature of life must be sought for in the peculiar phenomena with which life is associated. The essential characteristic of living bodies is nutrition, the product of two factors, one tending to build up the organization, the other to break it down—counting as part of the organism the food supply at any moment in the blood. Every manifestation of life involves, in this sense, organic destruction. Hence arises De Blainville's definition: "Life is a twofold internal movement of decomposition, general and continuous at once. In other words, life is a continuous dying." But there is a period when the formative element of life is predominant. In the young organism the up-building manifestly exceeds the breaking down of the organic structure. And at a still earlier period the phenomena of germinal evolution are the chief, if not the only, manifestations of life. These, however, do not differ in kind from the phenomena of nutrition; indeed, nutrition has been defined as continuous generation. The special agent of this essential life work is the germinal cell; hence arises another definition of life as the cell's impulse of organization, perhaps the closest definition that science has yet arrived at.

Whence arises that impulse? Is it a special, extra-material impulse? or is it only a mode of action of the general force of nature? Are the mysterious properties of the germ the result of molecular combination, as the properties of water arise from the combination of its constituent gases?

Here the final battle of biology must be fought. So long as life is surely known to proceed only from antecedent life, just so long will it be impossible to give a decisive answer to the question, What is life? The mystery of life lies in the evolutive power of the germ. If life is a vital spark handed down from organism to organism from the beginning, then it transcends the ken of physical science and must ever remain a mystery. If, on the other hand, life can be proved to begin *de novo* in suitable mixtures of demonstrably dead matter, as Bastian and other observers assert, that moment life ceases to be the only unique phenomenon in nature, and takes rank among the powers and potencies of ordinary matter. No wonder the controversy assumes at times a bitterness foreign to purely scientific discussions. The issues at stake are of transcendent importance, for upon the supernatural nature and origin of life hang the most revered beliefs, the most momentous theories, the most pretentious systems of the age.

THE DECLINE OF THE IRONCLAD.

There is something which forcibly reminds one of the ancient question of the irresistible force and immovable body, in the modern futile search for impregnable ironclads and unopposable guns. A recent writer in the *Revue des Deux Mondes* very pertinently compares the naval engineering of the present day to the quest for the absolute which occupied medieval astrologers, for in both cases, as fast as progress is made, new possibilities and new necessities seem apparent, until above all rises the obvious impossibility of predicting when the desired goal shall be reached. Neither can the colossal outlay of money and time expended in attempts toward the solution of the problem of guns and armor be said to have afforded other than merely negative results. Great Britain has paid millions to discover that certain armor is not impregnable, or the converse that certain guns are not irresistible, and at the present moment a leading British engineering journal candidly avows that the total result of all experience in armor plating has reduced itself to the quandary of whether it is better to use steel armor, which will resist penetration, but which will be quickly shivered by the projectiles, or iron armor, which will not split, but which will be pierced. In the matter of guns, which now are in advance, it would seem that the limit of the size to which they can be increased must soon be fixed by the capacity of vessels to withstand the concussion and shock of their discharge. The heavier vessels are armored the stiffer they are, the less elastic, and consequently the more liable to injury by racking strain; to gain elasticity by reducing armor is of course to lessen the protection.

So again, the whole question of constructing armored war vessels is about as unsettled as it very well can be. The Inflexible, supposed to combine in herself all the best expedients of advanced naval constructive skill, is a failure, and the verdict of an official board, translated into plain English, is, "Don't build another ship like her." Few concur in the proper mode of protecting a vessel. Some advocate unarmored ends and heavily armored citadel; some, heavily armored ends and lightly armored midship portion; some advise armor all over, even to far below the water line; some propose a mere belt; and so on in every variety.

If it were possible to cover a vessel all over with iron thick enough to stop the largest projectile, the problem would be easy to solve, but to do this is to render the ship unmaneuverable. She would be like a shark that has to turn over to bite, and while the fish turns the intended victim escapes, or if injured, like an armored knight of the olden time, who, when unhorsed, was at the mercy of his enemy, for his armor prevented his running away. In the Austro-Italian battle of Lissa, the ironclad Rè d'Italia became helpless from an injury to her rudder, and a wooden vessel, a mere transport hastily fitted up for action, rammed her and sent her to the bottom at a single blow. A more suggestive instance happened during the late Russo-Turkish war, in the splendid attack of the unarmored Russian gunboat Vesta on one of the largest Turkish ironclads. The battle was fought at rifle range, and in a short time two of the Vesta's guns were dismounted, her rudder was jammed, and a fire near her magazine broke out, while the Turk poured in 15 inch and 7 inch shell as fast as his six guns could be worked. Just as the destruction of the Vesta seemed certain, a lucky shot from her alighted on the Turk's unprotected deck and struck his boilers, and with what steam the latter had left he ran away, the Vesta's injuries unfortunately preventing her following up her advantage.

Such instances as the above, besides the other considerations stated, are sufficient to show the inefficiency of heavy ironclads, without bringing torpedoes into the question at all; but as these terrible engines of war must play the chief part in all future naval conflicts, the disappearance of the heavy ironclad will be the almost certain consequence of their employment. At the time we write, the finest of England's fleets lies virtually at the mercy of torpedo attacks, and there is no concealment made of the anxiety occasioned thereby. The crews are kept constantly vigilant, guns are kept loaded, signal stations established, and every possible precaution taken in the face of the mere possibility that hostilities may break out. It is openly doubted, if the Russians succeed in gathering the torpedo craft, planting the fixed torpedoes, and increasing their movable torpedo armament on the Dardanelles (which measures are known to be afoot), whether the English squadron can make its escape from the *cul de sac* in which it has placed itself. The Austro-Italian war, short as it was, showed the inefficiency of armored vessels. In the Franco-Prussian war the French were unable to use them at all. The Russo-Turkish war has again shown their disadvantages; and an Anglo-Russian conflict, it would seem, can only furnish positive proof of what is already reasonably made certain.

Symptoms of reaction from the ideas which generated the modern ironclad are already visible. Far-sighted Germany, although recognizing the fact that her ironclads are no longer formidable compared with those of later date, refuses to build any more heavily armored vessels. For the protection of her coasts, light draught gunboats carrying large guns will be constructed, and her fleet, it is said, will be used for defensive purposes, never going into action at sea except when forced into it, or under specially favorably conditions. The days of such exploits as those of Farragut at New Orleans and Mobile are gone by, for torpedoes render them impossible. Invasions by fleets are obsolescent, and all signs indicate that the navy of the future will be such defensive gunboats as Germany contemplates, and light swift cruisers whose sole duty will be the destruction of an enemy's commerce.

CONGRESS AND THE PATENT OFFICE FUNDS.

It has been the practice for some years past, says a correspondent, to pay into the United States Treasury all the fees received at the Patent Office, and for Congress to appropriate such money from the general funds as it thought fit, to carry on the business of the Patent Office; the amount appropriated lately being generally more in accordance with the ideas of the particular congressmen having charge of the appropriation bill than with the necessities of the case as pointed out by the amount asked for on behalf of the Patent Office.

The appropriation of $106,680, asked for by the Patent Office for the current fiscal year for printing the *Gazette*, the specifications of patents, patent heads, etc., titles to drawings, etc., was cut down to $65,000, although it was well known from the experience of previous years that the amount of printing required to carry on the business of the office could not be done for that sum, unless the number of patents issued fell off in proportion, of which there was not the least probability. Nevertheless, although the necessity for the whole sum asked for was capable of mathematical demonstration, Congress in its misdirected desire for economy refused to appropriate anything more than the sum mentioned; and as a result the appropriation has all been expended on needed work, which causes the stoppage of the printing of the Patent Office *Gazette* with the issue of March 26, and of the specifications of patents with those bearing date April 2. As the patents cannot be sent out without the printed specifications, the patents which should be issued on the succeeding weeks will have to be suspended until Congress appropriates more money, by the deficiency bill now before it, to carry on the printing.

In the deficiency bill, the $40,000 asked for to finish the printing for the remainder of the fiscal year has been cut down to $30,000, and it may be yet further reduced before passing both houses. To get along with the $30,000, even if that much is granted, the printing of the Alphabetical Index of Patents, which has been in preparation some time, will have to be postponed. This work, when published, will be a great help to inventors and attorneys, and it is believed that every dollar spent on it will be returned to the Patent Office in the sales of copies.

It is now proposed to cut down the examiners' salaries from ten to fifteen per cent, when it is well known that many of the best officers resign even at the present salaries because they can obtain a better income outside the office than in it. If the Patent Office is to be, as it ought to be, provided with a corps of examiners capable of appreciating the nice points of inventions, skilled in mechanics and learned in the law, fair salaries will have to be paid. Economy on this point may save a few thousands to the Treasury, but a single patent wrongfully issued may cost the public many times more than the saving thus effected, and a patent refused that ought to have been granted may delay the introduction of an invention that would save the people generally tenfold the amount saved by the proposed reduction of salaries.

For several months past the "burnt district" of the Patent Office has had nothing but a temporary tarred paper roof on it, although a large portion of the business of the Patent Office, and much of the Interior Department, is done in that part covered by the paper roof, and much inconvenience is felt for want of room. The attention of Congress has been called again and again to the necessity of something being done to remedy this, but thus far without result.

Now, why this mistaken policy of stinting the Patent Office? Is it because the Government is so poor that the money cannot be raised to make the needful appropriations for printing, paying proper salaries, and for necessary repairs? If this were so, and the Government had to pay out its own money, there might be some excuse. The Government, however, is not called upon to pay a penny of its own for either of the purposes mentioned, as it now has lying idle in its coffers over eleven hundred thousand dollars belonging to the Patent Office funds, which the office has received over and above expenses and paid into the national Treasury, every cent of which of right belongs to the Patent Office and should be kept for its use. Congress can find time and money enough to provide tens of thousands of dollars for an unnecessary mint in New Orleans, and appears willing enough to appropriate hundreds of thousands of dollars for the payment of confederate mail claims, but is not willing that the Patent Office—the only government institution that is purely self-sustaining—should control and spend its own revenues. All that is wanted from Congress is that the Patent Office may help itself with its own income, that it may use some of the money that it has garnered up, not from a tax on labor but as the price of protection to inventions, which money should be devoted to that purpose, to the encouragement of inventors, and to spreading information that may help them on their way, and not be allowed to lie in a constantly accumulating hoard, doing good to none.

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New Inventions.

Mr. L. P. Taylor, of South Orange, N. J., has invented an improved Type Holder for Hand Stamps in which regularly recurring changes are made. The type box, having one or more compartments, is provided with lifters and followers which raise the type in turn, as desired, in a simple manner.

Mr. Jonathan Miller, of Hinrad's, N. Y., has improved upon the Apparatus for Making Tea or Coffee, previously patented by him, by modifying its form so as to adapt it to be made of stone ware.

An improved Latch, for barn doors and similar positions, has been patented by Mr. B. Hollingsworth, of Sigourney, Iowa. It consists of a pendent bolt dropping into blocks on the door casing and locking the latch proper, which is opened by a string from the outside, as usual. The bolt is raised or lowered by means of a cord, which is carried by pulleys to a convenient and concealed terminus.

Mr. H. L. St. Clair, of Vineland, N. J., has invented an improvement in hand Washboards. The bed, or friction surface of the board, is formed of rollers, which are square or polygonal in cross section. The labor of rubbing clothes on such a surface is obviously less than on a fixed surface. One of the side bars of the washboard is provided with a hinged section, which permits the rollers to be easily put in or removed as required.

A new Fire Escape has been invented by Mr. Sylvester Root, of Kentland, Ind. A drum, having two separated grooves, in which ropes are attached so as to wind in opposite directions, is mounted in a frame which is hinged at the side of the window casing, so that it will swing into and out of the window. The free end of the swinging frame is provided with hooks to catch on a bar which spans the window casing transversely, and serves to support the frame when the drum and ropes are in use.

Mr. E. F. Gordon, of Concord, N. H., has invented a strong and simple Clamp for general use. At the lower end of the standard a beveled head is formed, which fits into a dovetail slot in an iron strip let into the bench. The sliding arm of the jaw is operated by an eccentric lever, which is shaped so as to prevent it from turning when the jaw is under pressure.

A new process and apparatus for Extracting Glycerin from Fats has been invented by Mr. Frederick Sahlfeld, of New York city, who employs steam for the purpose of mixing the fatty matter and chemicals; not by direct action, but indirectly by the use of revolving steam-heated stirrers, the mechanical action and the contact of the surfaces of the stirrers with the fatty material expediting the separation of the glycerin.

An improved Chimney Cowl consists of a pipe closed at its upper end, and having lateral discharge openings near the top, and surrounded by a thimble, between which and the pipe are formed vertical passages for the discharge of smoke and movement of wind. This device has been patented by Mr. J. W. Androvatt, of Prince's Bay, N. Y.

Mr. Moritz Leiner, of New York city, has patented an improved Brush, for bathing and other purposes, composed of a series of round brushes made of bristles retained in twisted wire strands, the brushes being attached to flexible bindings at the ends, and provided with a suitable handle.

A convenient Device for Sizing Rings, intended for the use of jewelers, has been patented by Mr. Edward Davies, of Brooklyn, N. Y. It consists of a die plate having a number of tapering holes of different sizes, in connection with a corresponding number of tapering punches having annular recesses at the ends, fitting the different sizes of rings, and either contracting or expanding them by driving them into the die holes.

Influenza.

Dr. D. H. Beckwith, in a paper published in the Cincinnati *Medical Advance*, says: "That theory which commends itself to my acceptance is that a deficiency of ozone in the atmosphere will cause influenza, catarrh, hay fever, cholera, scarlatina, and diphtheria, while an increase of ozone in the air will increase bronchial and pulmonary diseases.

"Ozone is defined to be 'oxygen in an active or highly negative state.' Ozone is a constituent in the air, and is remarkable in its properties. It has an odor similar to a spot that has been struck by lightning. In quantities—that is, an excess in the atmosphere—'it will attack the mucous membrane of the throat, nose, mouth, and bronchia,' so says Hartly. Short says, in his 'Chronological History of the Weather:' 'Thick ill smelling fogs are preceded by attacks of epidemic catarrh.'"

IMPROVED MACHINE TOOLS.

[*Continued from first page.*]

which the same automatic movements are repeated, completing the wheel. The spindles run in anti-friction boxes

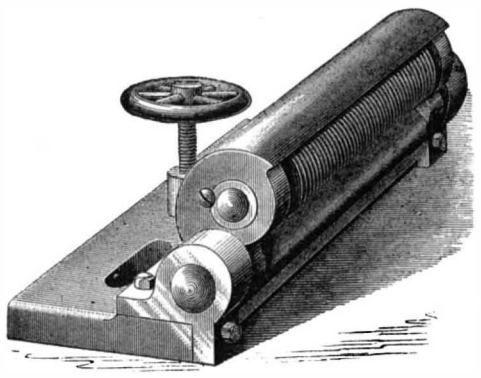


Fig. 4.—GRINDSTONE TRUING DEVICE.

provided with means of compensation for wear. The machine is of neat design and carefully constructed, and is accompanied with complete self-oiling overhead works. Special fixtures for wheels of any given form and size can be readily attached, while, on the other hand, one machine only can be supplied if required. With the two machines upon the one bed the weight, including the overhead works, is about 1,000 lbs. The heads, having what is technically known as a box frame, are very strong and rigid in proportion to their weight, while their interiors can be used as closet room for the cutters.

Fig. 3, page 271, shows an automatic balance wheel turning machine, designed for the automatic turning of the circular rims of balance wheels, such as are used upon sewing machines, small lathes, and other light machinery. The work is performed by two cutting tools, operating upon opposite sides of the wheel at the same time. These tools are automatically revolved in a horizontal plane about the rim of the wheel, in opposite directions, so that one quarter revolution of each tool post completes the half circle, and then both the spindle of the machine and the tool posts automatically cease revolving. The centers around which the tool posts revolve are adjustable, and allow a variation in the size of the wheel to be turned of from 6 inches to 7 inches in diameter, this adjustment being made by simply turning a screw.

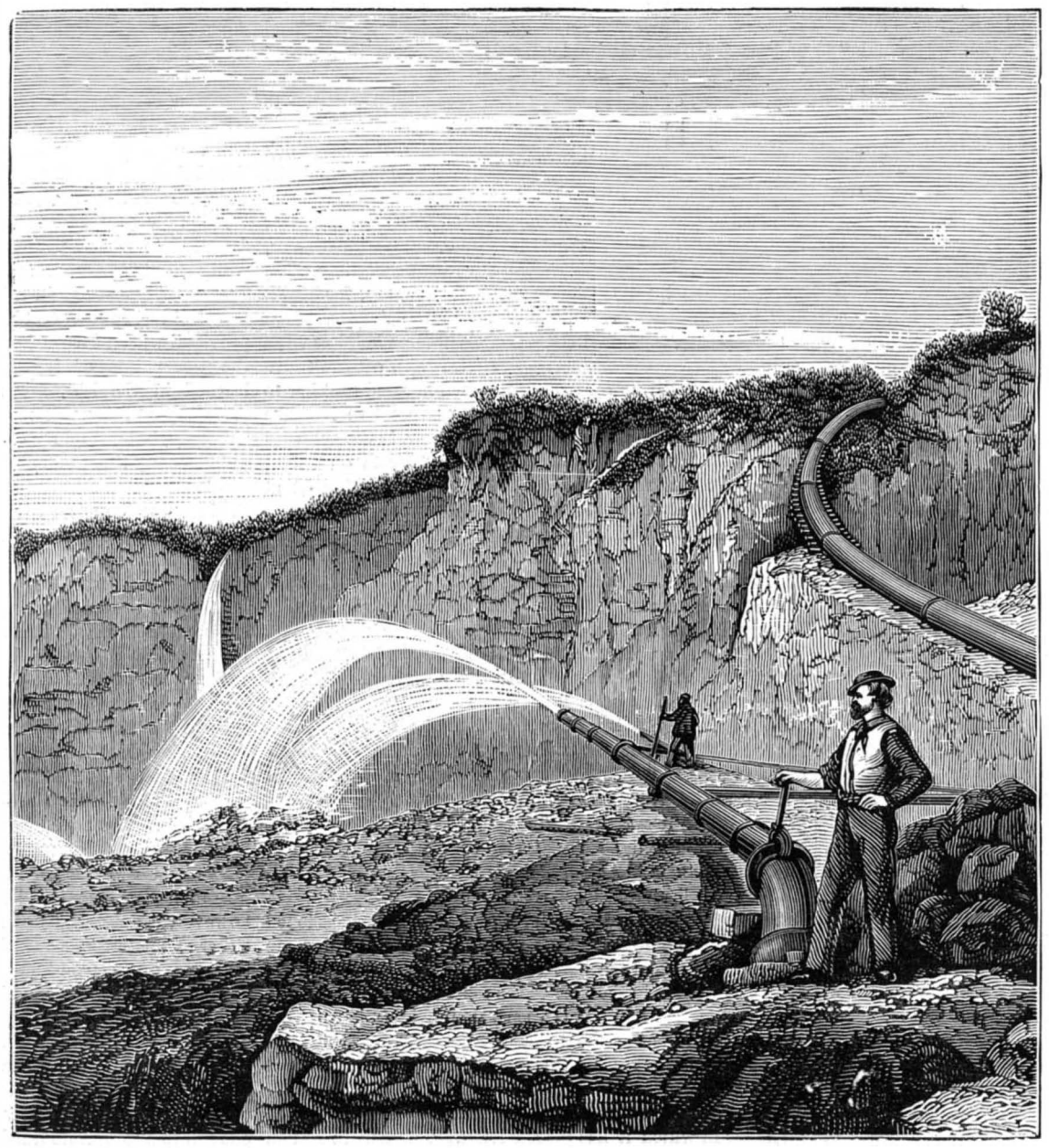
The feed works or motion are all inclosed in the base of the machine, and are readily accessible for oiling. The spindle of the machine is of steel, made with large bearings working in boxes, which are provided with means of compensation for wear, and is strongly geared. The cone has two speeds, and is driven by a belt 1¾ inch wide. With the countershaft, self-oiling hangers, etc., the machine weighs nearly 1,000 pounds.

Driving Piles in Sand.

The contractors who had charge of preparing the sheet piling which was to protect the hospital at Berck-sur-Mer, in France, were much troubled in driving the piles by the compactness of the wet sand, and finally made use of tubes which were driven at the same time with the pile, their lower ends being a few inches below the points of the piles; through these tubes water was forced by small hand engines, and so loosened the sand that the advance of the pile was easy and rapid. In the case of the panels of sheet piling, the benefit was even more marked. Careful observations showed that by the ordinary process it took, on an average, 185 strokes to drive a ten inch pile ten feet, while 900 blows were needed to drive the panels. The hammer weighed 1,320 pounds, and had a fall of six and one half feet. The average time required to drive a pile and panel was eight hours and a half. After the device of loosening the sand by the pressure of water was adopted it was found that the average time required to accomplish this was one hour and nine minutes, while to drive a pile and a panel more than fifty blows were never required, and often the mere weight of the hammer was enough to sink the pile.

HYDRAULIC MINING IN CALIFORNIA.

The rich gold placers of California, where for a brief period fortunes were made by the use of the most primitive appliances, such as the pan, the rocker, and the "long tom," soon became exhausted, and it became necessary to turn to the original sources of gold in the quartz veins, or to work, by combined and systematic effort and the aid of modern mechanical improvements, the masses of auriferous gravel which contained too small a proportion of the precious metal to be profitably treated by the early crude processes. Our engravings give a good idea of how the latter is accomplished.



HYDRAULIC MINING IN CALIFORNIA.

In place of the pick and shovel, the disintegrating power of water is employed to break up the gravel, often cemented together and containing huge bowlders, and convey it to the flumes, where the gold particles are separated by riffles, blankets, and other devices depending upon the action of gravity or the attraction of amalgamated plates. The success of operations depends rather upon the cheapness and amount of the water supply than upon the richness of the gravel; so low a proportion as 15 to 20 cents' worth of gold to the cubic yard of gravel being at times profitably extracted; while much richer gravel, in places where water is not abundant or has not the requisite fall, often fails to pay.

The water is conveyed from the upper reservoirs by wrought iron pipes capable of withstanding the pressure of a head of water many hundreds of feet high. The limit of strength of the best canvas hose of the necessary diameter is only about 50 feet perpendicular, and 180 feet when braced by "crinoline" of iron or rope netting; and hence it was soon displaced by the stronger material in all permanent workings. The usual dimensions of the iron feed pipes are from 22 inches to 40 inches in diameter, and 0·06 inch to 0·2 inch in thickness, or from No. 16 to No. 7. The water is led to a cast iron distributing box, permanently fixed, and from thence by short pipes to the nozzles. A great deal of ingenuity has been expended upon the construction of these nozzles, and the forms now in use are very effective and easily directed. The stream discharged from them has frequently a

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velocity of 150 feet per second, and at a distance of 150 feet to 200 feet speedily undermines the most refractory bank. The engraving on page 274 shows the mode of application, and that at the bottom of this page illustrates a common scene in the foothills of the Sierras, where dozens of streams may often be counted from a single point of view.

The main obstacle in hydraulic mining is not to find material, but to get rid of the refuse. The enormous amount of matter turned into the rivers has obstructed the currents, deposited barren sediment by millions of tons where it was not wanted, and has necessitated the construction of costly levees along the banks of the rivers. The beds of auriferous gravel are from a few feet to several hundred feet in depth, and are measured on the surface by the square mile. The problem of providing a suitable dumping ground is steadily growing in importance.

Hydraulic mining differs from all other kinds of mining in that it is nearly free from chance. A given yard of gravel in the center of a bank is a fair sample of the whole, the gold being distributed with remarkable uniformity. Hence, the price of water (which is usually supplied by independent companies), rate of wages, and a few other items being fixed, it is a simple matter to calculate in advance whether a projected enterprise will be profitable, and if so to what extent.

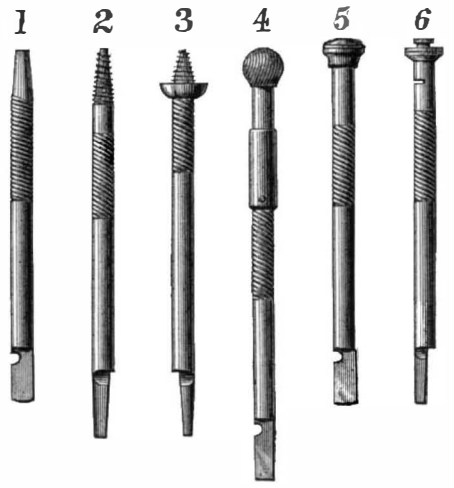
Iron Chip Removed from the Eye by a Magnet.

At a recent meeting of the Clinical Society of London, Mr. McHardy read notes of a case of removal of a chip of iron from the crystalline lens by means of a powerful magnet. The patient, thirty-one years of age, when at work, was struck in the eye by a fragment of steel from the hammer he was using. When seen, twenty-four hours after, there was evidence of commencing iritis; there was nothing in the vitreous; the eye was less painful than on the night of the accident; its tension normal. Atropine drops were prescribed. The next day there was no pain, and less congestion of the eye; the pupil was well dilated, and allowed of detection of a sharply defined opacity on the interior surface of the lens in a downward-inward direction from the center, the peripheral end being nearer to the margin of the dilated pupil. The cornea was almost normal. The atropine was continued, and absolute rest enjoined. The removal of the chip appeared to be imperative lest it should gravitate downward; at the same time Mr. McHardy was unwilling to remove the lens, and he also thought if it were injured by the forceps it would not be easy to tell if any subsequent opacity of the lens were due to the original injury or to the operation. He therefore had a magnetic spatula constructed by Messrs. Weiss, intending to use it in connection with an electro-magnet. On Mr. B. Carter's suggestion the procedure was modified by employing a powerful bar magnet connected with two Grove's cells. Gradually approaching it to the front of the cornea, when it was four inches away, the chip sprang from the lens to the inner surface of the cornea, and fell into the anterior chamber, whence it was removed, together with a small portion of iris. A patch of opacity exactly corresponding in size to the chip was left on the lens. Subsequently a cataract formed, and the injured lens became absorbed. The patient's vision, aided by a lens of twelve dioptrics, is normal for distant objects. Mr. McHardy acknowledged his indebtedness to Mr. Ladd and Dr. Tibbits for assistance and suggestions, and he referred to a paper by Dr. McKeown, in the *Dublin Journal of Medical Science* for September, 1876, where three or four cases are recorded of the use of magnets in the removal of fragments of steel in the eye.

Mr. Brudenell Carter, having seen the case, stated that the position of the fragment was such that any other attempt at its removal would have jeopardized the eye. If nothing had been done, the fragment would probably have fallen below the iris, and would have set up destructive inflammation; and any attempt at its removal by forceps would certainly have injured the lens. By withdrawing it from its bed and bringing it to the front of the iris, the magnet had obviated these difficulties.

IMPROVED TOOL STOCKS FOR DENTAL ENGINES.

The accompanying engraving represents various forms of a new tool stock for dental engines, which is made flexible. By this construction it is claimed that the various operations of smoothing rough surfaces upon teeth, and of shaping, smoothing, and polishing complicated gold filling, will be much more pleasant to the patient and convenient to the operator, than when the same is done with wheels, disks, or points mounted upon rigid stocks. There is also much less liability to break thin and delicate corundum disks.



DENTAL TOOL STOCKS.

The stock is formed by coiling a wire spirally, and then coiling a second wire in similar manner about it in opposite direction. The wires do not uncoil. The device may be made flexible along its entire length, or partly flexible and partly solid, so as to possess various degrees of softness. In the illustration, 1 is a plain drill stock; 2, a screw head without shoulder; 3, same with shoulder; 4, stock for carrying wood points and large plug finishing burrs; 5, screw head, pattern of Dr. Robert Huey; 6, pattern of Dr. John M. Hurtt.

Patented through the Scientific American Patent Agency July 24, 1877. For further information relative to manufacture on royalty, purchase of patent, etc., address the inventor, Dr. Edwin Telle, New Orleans, La.

New Test Paper.

The *Deutsche Industrie-Zeitung* states that the paper and chemical manufactory of Eugene Dieterich, near Dresden, has lately produced a test paper colored, by means of machinery, with alternate stripes of red and blue litmus. For use, the paper is cut so that stripes of red and blue lie side by side on the same piece. This affords a convenient means of ascertaining whether a solution be acid or alkaline, by a simple dipping of one and the same piece of paper, instead of using two kinds, as in the old method.

The Bricklayers' Strike.

The success of the bricklayers' strike for an increase of wages affords a notable indication of revival in at least one line of business. This is the first instance of the sort since the panic. In every case builders with large contracts on hand promptly yielded without dispute to the restoration of the rate of pay to the standard formerly agreed upon. The leaders of the Bricklayers' Society are naturally elated, and express the opinion that the summer will bring still higher wages. Work on the Brooklyn Bridge was not hindered, the men at work there being paid at the rate of $2.50 a day.

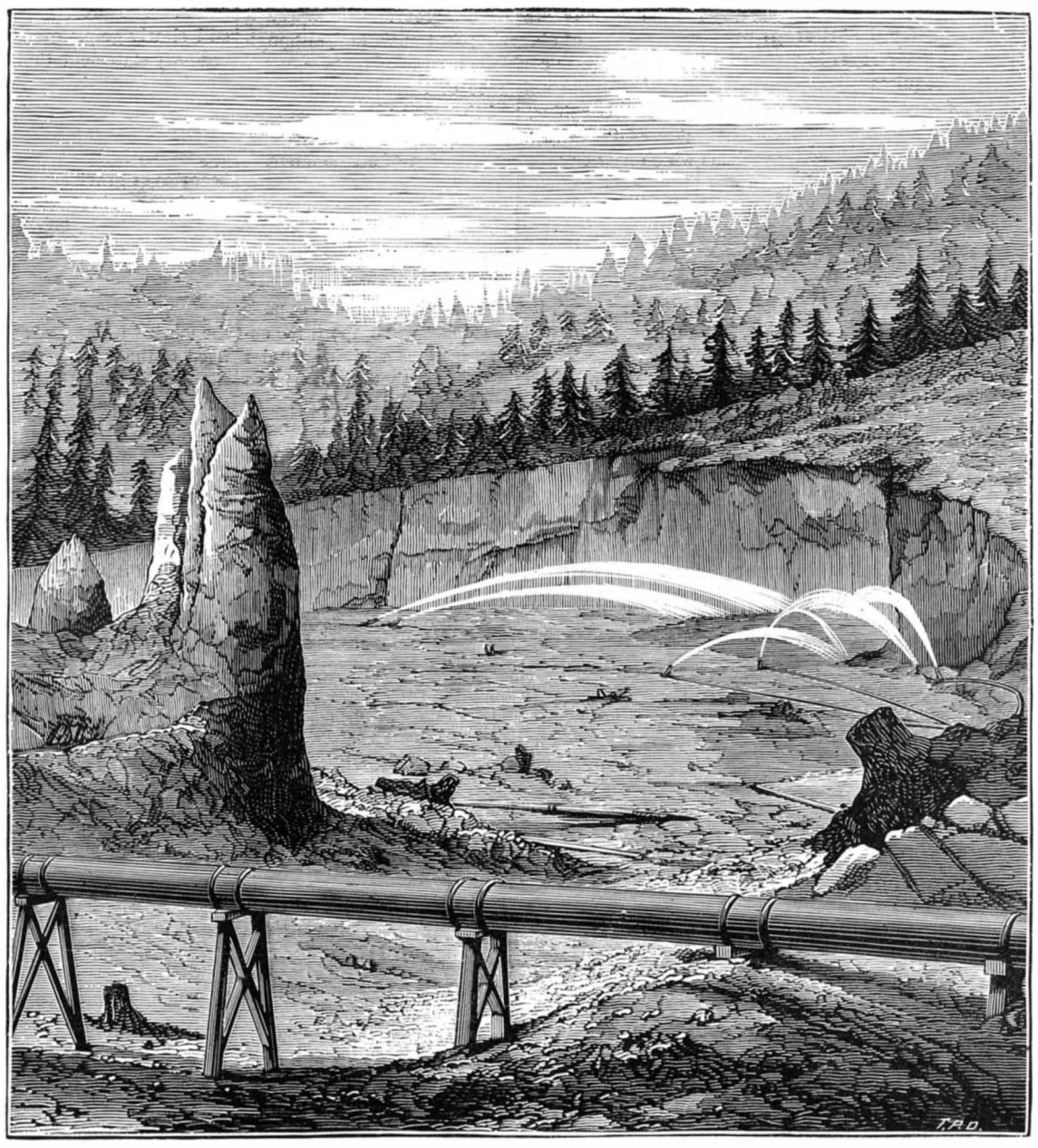
Bee Stings.

Mr. J. D. Hyatt, President of the New York Microscopical Society, gave an account of his investigations on the subject of stings. These studies have extended over a period of eight years, but only recently have some obscure points been made out. The general form of the stinging organs of the honey bee is well known by microscopists. It consists of a horny sheath, within which there are two stings, and these, when in use, are thrust out. There is a poison bag which discharges its contents into the sheath. This is a point well known, but it appears that the precise method by which the fluid makes its way from the sheath into the wound has not heretofore been properly explained. According to the generally accepted explanation the poison is supposed to flow in a channel formed between the two piercers or stings, and in this way makes its way into the wound. Mr. Hyatt advances another hypothesis, and believes he has positive proof that he is right, having dissected and examined upwards of a thousand stings.

On examining a properly prepared sting from a honey bee we notice first that the piercers are very sharp, and barbed for some distance from the end, there being nine barbs pointing upward on each one. These barbs are gracefully curved, and it can easily be seen that when once they find their way into the flesh it would be difficult to withdraw them. This explains why the honey bee sting remains in the flesh, while the stings of other insects, with finer barbs, are withdrawn.

A more careful observation indicates that the stings are tubes. There appears to be a channel running through the length of each one, having branches which terminate in the notches just above the barbs. After careful study of these channels, many of which were found to contain air or water after mounting, and were thus proved to be veritable channels, the question arose as to their use. The natural inference would be that they were ducts for the poison, but there could be found no possible connection between the poison gland and these channels, for, as already stated, the poison flows into the sheath.

After long and patient investigation the explanation offered is as follows: At the back part of the sting these channels open into the sheath, and just in front of that opening, attached to the stings, is a sort of valve which projects into the sheath. When, in the operation of stinging, the piercers are thrust out, they carry forward this valve so as to close the front of the sheath, for which purpose they are admirably adapted, and the poison thus confined within the sheath makes its way out through these openings in the stings. When once understood the operation seems very simple. There are also some objections to the common explanation. Cross sections of the stings show that the walls are quite thin, but strengthened in certain places by internal deposits. The form of the stings is such that no channels can be formed between them to conduct the poison.



HYDRAULIC MINING IN CALIFORNIA.

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Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

The appropriation for printing the *Gazette*, specifications, etc., at the Government printing office having been exhausted, the work of printing those documents will have to be stopped until a new appropriation has been made. The Government printer has withdrawn that part of his force employed in the branch office in the Patent Office building for the same reason, and the printing of patent heads, titles on drawings, etc., usually done in that room, has been stopped. The *Gazette* has been suspended with the issue of March 26, and the specifications bearing date April 2 are the last that will be printed until the deficiency appropriation bill has been passed. As the specifications cannot be printed, the issue of patents will have to be delayed, because the patent cannot go out without them. As no specifications will be printed during the interregnum, it is proposed to put the proof-readers, who are paid out of the Patent Office funds, to work at printing the titles on drawings, and thus the work of photo-lithographing may go on as usual. This interruption of the current work of the office is the result of the cutting down the appropriations by Congress, irrespective of the actual wants of the service; and this particular instance is but a specimen of many of the results of the diminished appropriations of last year. The Post Office is now in the same position as the Patent Office with respect to printing, and thus the work of the country suffers from the petty tricks and false economy of our Congressmen, who, to appear economical and to cover up their own shortcomings, cut and slashed away at the appropriations asked for, totally regardless of the necessities of the case.

Of a piece with this is the attempt now being made to cut down the salaries of the examining force from $200 to $250 each per year. If the public is to be served properly, proper salaries must be paid. The salaries now paid to the examiners are not sufficient to keep good men in that body, because they can procure a better income outside as patent solicitors, and if the bill is passed cutting down salaries, there is no doubt but that many of the best men will leave their positions in the examining corps, and their places be filled by less competent men.

PROTECTION OF ATTORNEYS.

A bill has been introduced before Congress for the better protection of patent attorneys. It provides for repealing Section 487 of the Revised Statutes, and requires all proceedings for suspension or disbarment of any attorney or patent agent from practice, before any bureau or department of the Government, to be commenced and determined before the Attorney-General, according to the usual rules of law and judicial proceedings. In case any such head of bureau shall disbar or suspend a practicing attorney arbitrarily, he shall be subject to a fine of from $1,000 to $5,000, and to imprisonment of from six months to two years, at the discretion of the court. The bill also provides that all persons who have been heretofore disbarred or suspended from practice as attorneys or patent agents before the Patent Office, or any other bureau or department, without charges having been made, due notice given, or proper opportunity given for defense before a competent tribunal, shall be restored to the roll of patent attorneys, and are authorized to act with the full powers and privileges from and after the passage of the act.

CONSULTING NATURALIST FOR THE AGRICULTURAL DEPARTMENT.

Senator Edmunds has introduced a bill providing for the appointment of a consulting naturalist to be attached to the Department of Agriculture, to investigate the following subjects: The better preservation of army and navy stores; the cause, prevention, and removal of infections; microscopic, parasitic diseases of men and animals, such as diphtheria, Texan cattle diseases, hog cholera, etc.; and to conduct such other investigations as may tend to the destruction of the cotton worm, the army worm, the weevil, the Colorado beetle, the grasshopper, and the curculio. He is also to set on foot investigations looking to the efficient preservation of butter, cheese, eggs, and fruit. The new officer is to be appointed by the President and confirmed by the Senate. His salary is left blank in the bill as introduced, but if he succeeds in half the work laid out for him, no amount that Congress is likely to fix will begin to equal the value of his services.

STANLEY'S AFRICAN DISCOVERIES.

The United States commercial agent at Gadoon reports to the Department of State that the knowledge derived from Stanley's discoveries on the Congo, or Livingstone river, is already bearing practical fruit. English missionaries have followed the course of the river as far as the first series of rapids, and are about to establish a missionary station at that point. It is reported that a modified form of the slave trade still exists between that region and the Portuguese islands of St. Thomas and Princess, through former agents of the slave trade between Gadoon and St. Paul de Loanda. A British gunboat recently captured a brig with over a hundred men, women, and children on board, in a miserable condition, who had been captured, baptized, and shipped near St. Paul as "free laborers." The spirit of the slave trade still exists, and if not carefully watched, will find means to revive and increase.

In this connection it may be stated that the Department of State has received information that the international expedition to Africa inaugurated by the Belgian Government, has lost two of its most worthy members, who died at Zanzibar—L. Crespel, the commander of the expedition, and Arnold Maes, the naturalist. The first died of sunstroke, and the latter of Zanzibar fever.

RAILWAYS IN THE NORTHWEST.

The United States Consul at Winnipeg writes to the Department of State that there is much activity in Manitoba in relation to railway matters. Canadian and English capitalists have purchased the first mortgage bonds of the St. Paul and Pacific Railroad, and propose to construct the northern extension in Minnesota, from the Red Lake River to the Manitoban frontier, and have it in running order during the coming summer. They also propose to lease and complete the Pembina branch of the Canada Pacific Railroad to connect with the Minnesota extension, and by November next it is expected that trains will be running from St. Paul to Winnipeg, and to a point twenty miles further north, where the branch line crosses the Canada Pacific road at Selkirk. From this point contracts are in execution for the construction of the main line eastward to the Lake of the Woods, so as to be completed during 1880. An equal distance westward of Thunder Bay, on Lake Superior, is also to be completed at the same time, and much pressure is being brought to bear on the Canadian government to procure the completion of the connecting links of the main road, but financial embarrassments will probably retard the work. The consul thinks that mutually profitable intercourse between the Western States and the Dominion would be greatly aided if the United States and Canadian governments were to make arrangements for aiding the construction of an international system of railways from Ottawa to the Sault Ste. Marie and thence to the Montreal river, there to connect with the Northern Pacific Railway, besides completing the latter eastward to Duluth.

THE TRANSIT OF MERCURY.

A transit of Mercury, by which it is expected that some important points in astronomy will be settled, takes place on May 6, and the astronomers at the Naval Observatory have sent out a pamphlet to many amateur astronomers, setting forth the desirability of having as many observations from different points as can be made, and giving directions by which those who wish to coöperate with the observatory can do so to the best advantage. Congress has appropriated $1,500 for the purpose of observing the transit, and, although the sum is not as large as could be used to advantage, yet it is believed that with the assistance of the amateur astronomers it will probably suffice, and that many interesting data will be gathered that will help to solve several interesting problems which now engage the attention of astronomers.

THE HOWGATE EXPEDITION.

Captain Howgate and his friends are beginning to get uneasy on account of the delay of Congress in providing means to forward his projected expedition. They have no doubt but that when the bill making the appropriation is brought up in the House, it will pass without much opposition, but they are afraid that the delay will imperil the enterprise. Reports from Labrador and other high latitudes confirm the opinions entertained here, that no season so favorable to northern exploration has occurred for thirty years, as, owing to the mild winter just passed, comparatively little ice was formed, and this is now supposed to be breaking up and drifting south, as the European steamers report having encountered icebergs much earlier this season than usual. In view of this, it is hoped that if the expedition can get away from our shores by July 25, no difficulty will be experienced in going directly north as far as Lady Franklin Bay, about 82°, nearly as far as the highest point reached by any former expedition. Should these hopes be realized, and a base of supplies be established in that vicinity during the coming summer, the friends of the expedition say that its success would be certain, in view of the well considered plans on which it is based. To establish this base of supplies, however, it is necessary that action be taken as soon as possible, as all the time between this and the last day when such an expedition should start can be profitably used in making proper preparations, without which success is very doubtful.

Washington, D. C. R.

Steering Screw Steamers.

To the Editor of the Scientific American:

In the issue of the SCIENTIFIC AMERICAN for April 13, 1878, there is an article concerning some experiments upon the steering of screw steamers. Allow me to call your attention to a report which appeared in *Engineering*, September 15, 1876, by a committee appointed at Bristol, England, to experiment upon the steering power of the rudder. This committee consisted of the following gentlemen: Sir William Thompson, Mr. J. R. Napier, Mr. William Froude, and Professor Osborne Reynolds. In closing this report the following statement is made:

"It appears from these experiments that on the reversing of the screw, whether reversing the action or not, the rudder is nearly powerless to turn the ship, and that she will turn more rapidly, but in less room, when going full speed ahead."

I believe the peculiarity in steering to which you have alluded in your paper was satisfactorily demonstrated at that time.

ATSON A. COOK.

Hopedale, Mass.

The Public School Twang.

The Rev. E. E. Hale ascribes the shrill voice of American women to the custom of requiring little girls to "read up," as it is called, in our large schools. The teachers expect a child of five to fill with her voice a room fifteen feet high and fifty feet square; as a consequence the child changes her low sweet home voice to the school scream, and in the course of time the school scream displaces the natural voice. The necessity of "speaking up" in recitation, so as to be heard across a large or noisy room, might be added as a cause of spoiled voices. That the schoolroom has this tendency may be noted any day in the extreme "clamor cry" of female teachers. We have known not a few sweet voiced young ladies to acquire the discordant school marm voice very rapidly after taking charge of a large school room; and possibly the little girls may acquire something of the tone by unconsciously imitating their teachers. Mr. Hale says:

"I remember at the great dining saloon of the Bauer au Lac Hotel, in Zurich, both the largest and finest dining hall I ever saw, when 500 people were dining at once at their different tables, I could single out my own countrywomen in all parts of the hall, no matter what their distance, by the shrill yell, more or less nasal, with which they summoned the waiters, ordered soup, asked for a napkin, or passed from pastry to ice-cream. Above the general roar of the buzz-buzz-buzz of 500 voices in conversation, you could distinguish the war cry of these eight or ten American women, as you distinguish signal rockets at night above a long and dark line of intrenchments. A casual observer would have no difficulty in telling, at the end of the day, how much pastry these women ate, or how often their plates were changed. We are so used to it in a Sound steamer, or other hall where women are together, that we do not notice it here. You need to be in another land to know what it is."

Bottling Air for Future Examination.

During the Centennial summer samples of air were collected on various occasions upon the exhibition grounds at Philadelphia, and in the different buildings; also in this city, in Brooklyn, Hoboken, and on many of the Adirondack mountains, with a view to transmitting them to the chemists of 1976, to determine whether the earth's atmosphere is undergoing change. That the atmosphere has undergone enormous changes since the earlier geological ages is beyond a doubt. The present question is whether such changes are still slowly going on, and what their nature may be. The ordinary statement that the air has an invariable composition is not strictly true, since samples of air collected at different times and in different places are never found to be absolutely identical. The difference may be slight; but an apparently insignificant decrease in the percentage of oxygen becomes of grave importance when the deficiency, as is usually the case, is made up of less beneficial elements.

Port Wine Marks.

Several English surgeons have of late endeavored to remove this disfigurement from the human face, obliterating the mark without scar. In these cases the mark was confined to the right half of the face, and the treatment consisted of scarification by means of parallel incisions the entire thickness of the skin, made by a frozen scalpel, the skin being also frozen by means of the ether spray. The cuts were one sixteenth of an inch apart, and as soon as these were healed a second set of parallel incisions were made obliquely to the direction of the first set, and so on with a series of operations until complete. Perfect success was the result, as the port wine mark gradually faded away, and was finally obliterated without leaving a scar.

Instruments have since been prepared having sixteen parallel blades, which make the operation very simple to execute.

Vortex Rings.

Take a bandbox with a tightly fitting lid, in which cut a round hole 1½ inch diameter. Insert a piece of smoldering brown paper till the box is full of smoke. A tap on the bottom of the box will now start a ring from the hole, which, if the surrounding air be at rest, will sail for some yards distant. The form and internal motion of the rings can be better studied when they are produced by giving the bottom of the box a gentle pressure with the finger end. The ring then moves slowly, but soon breaks up. A candle can be blown out at a distance of several feet by aiming a ring at it. The circle is the equilibrium form of these rings, and their vibration about this form may be studied by using a long shaped hole instead of a round one.

A New Ozone Machine.

In a recent lecture on ozone and the atmosphere, at the Stevens Institute, Professor Leeds exhibited a new machine for the production of ozone in large quantities and in a very concentrated state. The oxygen, after cooling to zero, was deprived of every remaining trace of moisture by drying agents, and then passed through tubes highly electrified. The ozone so produced exhibited intense chemical energy, bleaching indigo instantly, oxidizing silver, etc. The generation of ozone during the decomposition of water by the galvanic current was also visibly illustrated. At the close of the lecture Professor Leeds pointed out the necessity of systematic observation upon atmospheric ozone in all parts of the country, and the great value of such observations in connection with the development and spread of diseases.

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ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, May 4, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury sets	7 13 eve.	Saturn rises	3 02 mo.
Venus rises	3 09 mo.	Uranus in meridian	7 00 eve.
Mars sets	10 40 eve.	Uranus sets	1 52 mo.
Jupiter rises	0 56 mo.		

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	9 11 eve.	Sirius sets	8 50 eve.
Regulus in meridian	7 11 eve.	Procyon sets	11 01 eve.
Spica in meridian	10 28 eve.	Aldebaran sets	8 36 eve.
Arcturus in meridian	11 19 eve.	Algol (2d-4th mag. var.) sets	9 18 eve.
Altair rises	10 24 eve.	Capella sets	0 29 mo.
Vega in meridian	3 44 mo.	7 stars (cluster) sets	8 18 eve.
Deneb rises	7 51 eve.	Betelgeuse sets	9 23 eve.
Alpheratz rises	1 23 mo.	Rigel sets	7 49 eve.
Fomalhaut rises	4 03 mo.		

REMARKS.

Mercury is at inferior conjunction May 6, making a transit across the sun's disk. Transit begins at 10h. 18m. morning; middle, 2h. 5m. evening; end, 5h. 52m. evening. To obtain the time at any other city, apply the difference of time between that point and New York city to the above figures. Mars is now at his greatest northern declination, and is very near the moon May 6, being only 2° south. Venus and Saturn are in conjunction May 6 also. The time of conjunction, right ascension, occurs after sunrise, but at the time Venus rises, 3h. 9m. morning, they will have nearly the same right ascension, and Venus will be 1° 15′ north of Saturn.

SATELLITES OF JUPITER.

I. Begins a transit May 7, 3h. 39m. morning. Reappears from an occultation May 8, 3h. 10m. morning.

II. Reappears from a transit May 7, 3h. 59m. morning.

IV. Reappears from an occultation May 8, 4h. 0m. mo.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they are sufficiently accurate to enable the observer to find the planets.

M. M.

Position of Planets for May, 1878.

Mercury.

On May 1 Mercury rises at 5h. 15m. A.M., and sets at 7h. 36m. P. M.

The transit of Mercury across the sun's disk occurs on May 6. Instructions for observing this phenomenon, which will be visible all over the United States, have been issued from the National Observatory. The planet will come between the earth and the sun, and will enter upon the sun's disk as a small, round, black spot (the diameter of Mercury is 12″, that of the sun 1906″) at about 4 minutes past 10 A.M., Washington time. It will remain upon the face of the sun more than seven hours. The principal interest to astronomers will be the expectation of obtaining accurate observations of the position of Mercury, in order to investigate the correctness of Leverrier's calculations of disturbing bodies between Mercury and the sun.

Mercury having passed across the sun will be west of it, and will rise before the sun. On May 31 it will rise at 3h. 34m. A.M.

Venus.

Venus will be very beautiful in the morning hours throughout the month. It will be at its greatest western elongation May 1, when it will rise at 3h. 13m. A.M., come to meridian a few minutes after 9 A.M., and set at about 3 P.M. It will easily be seen at meridian passage, at an altitude in this latitude of 46°. On May 31 Venus rises at 2h. 35m. A.M., and sets at 3h. 33m. P.M.

Mars.

On May 1 Mars rises at 7h. 33m. A.M., and sets at 10h. 46m. P.M. On May 31 Mars rises at 7h. 1m. A.M., and sets at 10h. 6m. P.M.

Mars passes by μ Geminorum and above it on May 11, and on the 31st is above and a little west of δ Geminorum.

Jupiter.

Morning observers will rejoice in the earlier rising of Jupiter, and although it is very far south, it will be very conspicuous in May. It rises on the 1st at 1h. 10m. A. M., and sets at 10h. 46m. A.M. On May 21 Jupiter and the moon will rise at the same time. On May 31 Jupiter rises at 11h. 16m. P.M., and sets at 8h. 48m. of the next day.

Saturn.

On May 1 Saturn rises at 3h. 30m. A.M., and sets at 3h. 12m. P.M. On May 31 Saturn rises at 1h. 38m. A.M., and sets at 1h. 28m. P.M.

Uranus.

On May 1 Uranus rises 22m. after noon and sets at 2h. 3m. the next morning. On the 31st Uranus rises at 10h. 26m. A.M., and sets at 0h. 6m. A.M. the next day. Uranus having passed above Regulus and toward the west, is slowly moving in the other direction, approaching Regulus again, but on the 31st is more than a degree above it, and to the west of it 2°.

Neptune.

Neptune rises on May 31 at 3h. 4m. A.M. It is so near the sun in its right ascension as to render it invisible.

PITCHES OF ENGLISH GAS PIPE THREADS.

Dia. of pipe in inches, ⅛, ¼, ⅜, ½, ¾, 1, 1¼, 1½, 1¾, 2.
No. of threads per inch, 28, 19, 19, 14, 14, 11, 11, 11, 11, 11.

The Keely Motor.

The Keely motor deception seems at last to be nearly exploded, and the secret of the means by which its inventor obtained his enormous pressure has been discovered. Mr. J. B. Knight, Secretary of the Franklin Institute, of Philadelphia, was recently allowed an opportunity to make a partial investigation of the machine, but when he asked the privilege of testing the gauge which recorded the pressure, he was refused. Professors Wm. D. Marks and George F. Barker, of the University of Pennsylvania, were afterwards invited to make a thorough study of the motor, and the results of their study are given to the public in a letter to the Philadelphia *Ledger* of April 6. They noticed a heavy wrought iron tube lying in front of the machine, but not connected with it, but just before the experiments it was connected. They at once suspected that in this tube lay the secret of the wonderful force, and that it contained compressed air secretly stored in it previous to their arrival. We give the conclusion to their report in their own words:

"At the close of the experiments, one of the writers said to Mr. Collier that he must consider the machine a fraud, unless it could be demonstrated beyond a doubt that compressed air was not stored in the wrought iron tube, and requested that the cocks in the end should be unscrewed; this Mr. Collier positively refused to do, stating that the tube was 'sensitized' (we do not know what he meant by 'sensitized'), and would require three or four hours' work to 'reinstate' it if the atmosphere was admitted. How puerile such an excuse was the writers leave for others to judge.

"On requesting Mr. Keely to operate the machine, without using the wrought iron tube, he admitted that he was unable to do so.

"On every occasion at which the writers have been present no one has been allowed to operate the machine but Mr. Keely himself, and none have been permitted to make any tests of any sort, or do more than look on.

"To attempt to apply the known laws of physics or mechanics to this machine without every facility being afforded for investigation, would be idle. An analysis of the so-called vapor by Dr. C. M. Cresson, revealed nothing more than common air, as stated by Mr. Keely himself. We observed in one part of Mr. Keely's shop a hydraulic screw pump, quite capable of producing pressures greater than ten thousand pounds per square inch, thus affording him the means of charging the tube so frequently mentioned above."

Our own opinion on the Keely motor is that it has been a success, not as a machine for producing force, but as a machine for swindling people out of their money.—*American Manufacturer.*

American Anthracite for Europe.

The Philadelphia and Reading Railway Company have entered upon an enterprise which, if successful, must prove of great advantage to Eastern Pennsylvania. It is nothing less than to create a European market for American anthracite, a variety of coal practically unknown in Europe. To this end, the company's new steam collier, the Pottsville, sailed from Philadelphia April 4, for Havre, laden with the products of the Schuylkill mines, and apparatus for burning them, for the purpose of illustrating at the Paris Exhibition the advantages of this clean, hard coal for domestic and manufacturing uses. Samples of anthracite of all sizes, from pea coal to a single mass weighing 16,000 lbs., will be exhibited by this company, together with maps, drawings, plans, etc., showing the vast facilities for shipping the coal. For showing practically the use of anthracite in this country, the Pottsville carried a variety of cooking and heating stoves for the exhibition, and also one of the company's refuse burning locomotives. This engine was built by the company for a fast freight locomotive, its peculiarity being a furnace designed for burning coal waste. The furnace grate, of sixty-five square feet, is composed of water tubes and intervening cast iron bars separated only three sixteenths of an inch. The engine steams freely with coal dirt fuel, which can be had at the mines so cheaply that this item of cost with one of these engines hauling coal trains is said to be only three cents a mile. The same grate is said to burn larger sizes of coal as well as coal dust, and with great economy. After the exhibition the engine is to be tendered to some European railway for a trial of its advantages there.

Type-Setting in Japan.

The advantages of alphabetic writing are nowhere more conspicuously shown than in a large printing office. The compositor stands within easy reach of every character he may have need of, and a boy can learn the position of each in the case in a few hours. It is quite another matter where each word has a distinct character, as in China and Japan. A correspondent describing the office of a Japanese paper says that a full font of Japanese type comprises 50,000 characters, of which 3,000 are in constant use, and for 2,000 more there are frequent calls. The type is disposed about the composing room on racks, like those in a reading room, and the compositors wander up and down the isles setting type and taking exercise at once. With so many characters it is no wonder that Japanese proof readers have to be men of intelligence and high scholarship.

The impossibility of telegraphing single-character words has kept this great instrument of civilization in foreign hands, and made it practically useless for the natives of China and Japan. To these the telephone is an especial blessing, which they are not slow to appreciate.

NEW YORK ACADEMY OF SCIENCES.

At a meeting of the Academy held Monday evening, April 1, Mr. I. C. Russell read a paper on

THE INTRUSIVE NATURE OF THE TRIASSIC TRAP SHEETS OF NEW JERSEY.

The author stated that although the trap sheets which traverse the triassic rocks of New Jersey and Connecticut are usually regarded as dikes of igneous rocks, yet proof of their intrusive nature is rarely given; and, as the igneous origin of these rocks had been questioned by some persons, he called the attention of the Academy to a locality where proof is positively shown that these sheets of trap were really forced out in a molten condition between the layers of sedimentary rocks. The trap ridges of New Jersey have a general north and south direction, usually conformable with the strike of the associated sandstones and shales which compose the great bulk of the triassic formation. The trap rocks also seem to be usually conformable in dip with the stratified rocks above and below them. For this reason, and also on account of the rare occurrence of the exposure of a junction of the trap with the stratified rocks overlying them—owing to the removal of the latter by denudation and to the line of contact being hidden by drift and vegetation—the supposition has obtained that the trap sheets were not intrusive, but were formed cotemporaneously with the shales and sandstones as a bed or stratum of igneous rock, spread out in a molten condition on the bottom of a shallow sea in which the stratified rocks were being deposited. He proposed to consider, then, (1) whether the plutonic rocks of the triassic were spread out in the form of a sheet of molten matter, and then cooled and consolidated before the rocks that rest upon them were deposited, both therefore being of the same geological period; or (2) whether the traps were forced out in a fused state among the sedimentary layers, after consolidation of the latter, which would make them more recent than either the over or underlying rocks.

To decide these questions he made an examination of the trap ridge, known as the First Newark Mountain, for some twenty miles of its course. He hoped through this examination to learn, in reference to the history of this mountain, (1) whether the sedimentary rocks that repose upon the igneous ones have been changed from their normal condition by the action of heat at the surface of contact; and (2) whether the trap sheets seem in all cases to be conformable in bedding with the stratified rocks with which they are associated. It is not difficult to find the junction of these igneous rocks with the shales and sandstones that underlie them; and in all cases the latter are found highly altered, and show plainly that they have been exposed to intense heat. This change may be observed at a number of places on the western shore of the Hudson beneath the trap rock forming the Palisades; in some instances the sandstones here have been metamorphosed into a compact vitreous quartzite. These observations very clearly show that the triassic traps were once in a highly heated, and probably molten, condition; and this is, moreover, shown by their crystalline structure. If these rocks had cooled and consolidated before the overlying shales and sandstones were deposited, the latter of course would show no such alteration as that we find in the underlying strata. As before mentioned, however, it is difficult to obtain proof of such alteration in the stratified rock above the trap. After many long excursions in hopes of finding an exposure, the author had been successful in but a single instance, and this was on the western slope of the First Newark Mountain, directly west of Westfield and near the little village of Feltville; at this point the desired junction is very plainly shown.

Here, in the sides of a deep ravine, which has been cut out by a small brook, the stratified rocks are well exposed. The trap rock, which appears in the bed of the stream, in some places presents its usual characteristics of a hard, bluish, crystalline rock. In other places it swells up into bosses and rounded masses, which penetrate the overlying rocks. The outside of these masses presents a scoriaceous or slag-like appearance; in the interior the cavities are filled with infiltrated minerals. The shales resting directly on these igneous rocks have, in many places, been disturbed from their normal position and greatly altered in texture and color. For the first two or three feet above the trap the shales have been so greatly metamorphosed that they are scarcely distinguishable from the trap itself. At a distance of six or eight feet above the traps the shales are still very much altered and filled with small, spherical masses of a dark green mineral resembling epidote. Midway up the ravine (which is thirty feet deep) the shales present somewhat their usual reddish appearance, but are filled with a great number of irregular cavities formed by the expansion of vapors while in a semi-plastic condition. At a distance of twenty-five or thirty feet above the trap, the shales and sandstones are changed but slightly, if at all, from their normal condition. A bed of limestone, from two to three feet in thickness, is here interstratified with the shales and the sandstones—a rare occurrence in the triassic formation of New Jersey—and where it approaches the trap it is considerably altered and forms a mass of semi-crystallized carbonate of lime. Near the junction of the metamorphosed shales and the igneous rocks beneath, the author found in a number of places a peculiar rock, composed of angular greenish fragments, bound together by a reddish cement, forming a typical breccia. This rock, in some places, is two feet or more in thickness; at other times it fills the spaces between concentric masses of igneous rock or metamorphosed shale. This interesting material seems to have a history somewhat similar to that of the "friction

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breccias" mentioned by Von Cotta as occurring at the margins of eruptive igneous rocks and formed at the time of their eruption. The section at Feltville furnishes indisputable evidence that the igneous rocks of the First Newark Mountain were intruded in a molten state between the layers of stratified rocks subsequent to their consolidation; and, from analogy, this conclusion should be extended to embrace all the trap ridges of New Jersey.

The distinctness with which this one question relating to the triassic trap sheets has been answered seems by contrast to make other questions in their history only more obscure. We cannot now determine in what age, after the consolidation of the triassic sedimentary rocks, the outbursts of trap occurred; nor whether the several trap ridges that traverse the triassic were formed at one time. It may be that one is thousands of years older than its neighbor.

Mr. Russell's valuable paper was illustrated by a complete series of triassic rocks from the locality at which his observations were made.

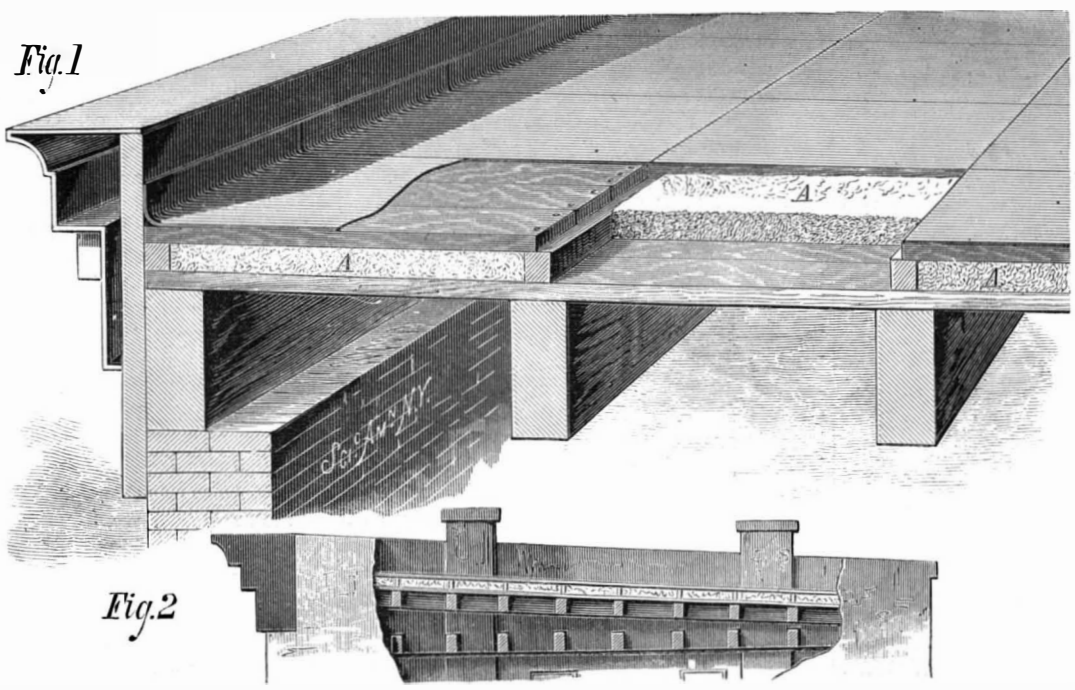
LINING ROOFS WITH MINERAL WOOL.

The advantages of the new application of mineral wool herewith illustrated are claimed to be as follows: The temperature in dwellings, etc., is insulated; the roofs are rendered practically fireproof as regards the spread of fire from neighboring structures, and the material not being liable to decay or rot, on account of moisture, dampness, etc., preserves the woodwork of the roof. It is further claimed of the cheapest grade of mineral wool to be used for this purpose that its non-conducting or insulating quality is equal to that of hair felt at even thickness, and superior to cements, mortars, etc. It weighs 28 pounds per cubic foot, or 3½ pounds per square foot over all, and as shown in the illustration is spread between studs 1½ inch high by 2 inches wide, and between two roofing floors of 1 to 1¼ inch planks. The wool, A, is leveled 1¾ inch high, and the upper planks are nailed on the studs, thereby compressing the wool ¼ of an inch, which is sufficient to render the lining compact and to prevent its settling in gable or French roofs.

Ordinary city dwellings, built in rows, are exposed to the rays of the sun on three surfaces, the front and rear walls alternately, and the roof nearly all the time. Considering that the temperature in the shade at 80° to 85° Fah., is about equivalent to from 125° to 135° Fah. in the sun, it might be asserted that more heat goes through the roof than through the walls.

We are informed that scientific tests (Franklin Institute) and practical experience show that a roof lined with 1 to 1½ inch hair felt or mineral wool, and 2 to 2½ inch thickness of wood (which itself is a good non-conductor), will insulate the temperature sufficiently to ward off the sun heat during the day or the extreme cold of winter nights. Hitherto the use of mineral wool for roofs was mostly confined to breweries, ice, and cold storage houses, as in these structures the questions of ventilation and insulation of heat and cold are of the utmost importance. The effectiveness of mineral wool for such purposes can now be attested to by quantities in actual use, representing in the aggregate a surface of over 300,000 square feet of 1 inch lining, though mostly used at 3 inch and 4 inch thickness for lining walls.

As to the security against fire from neighboring buildings the objection might be raised that apparently when the upper roofing planks are on fire the studs on which they are fastened and the other planks beneath them will also burn. On account of the wool between the studs no hot air can get beneath them, so that the studs are only exposed to the heat on top; and it is claimed they will only char, or at least be so slowly consumed as to give ample time for extinguishing the fire. Mineral wool being made from slag or scoria, at a heat of about 2,000° Fah., it is of course incombustible. For use on buildings it possesses the additional advantages of being (like felt) a non-conductor of sound, and it affords no abode to rats, mice, and vermin. The address of Mr. A. D. Elbers, who controls the sale and manufacture of mineral wool (made at Greenwood Station on the Erie Railway), will be found in our advertising columns.



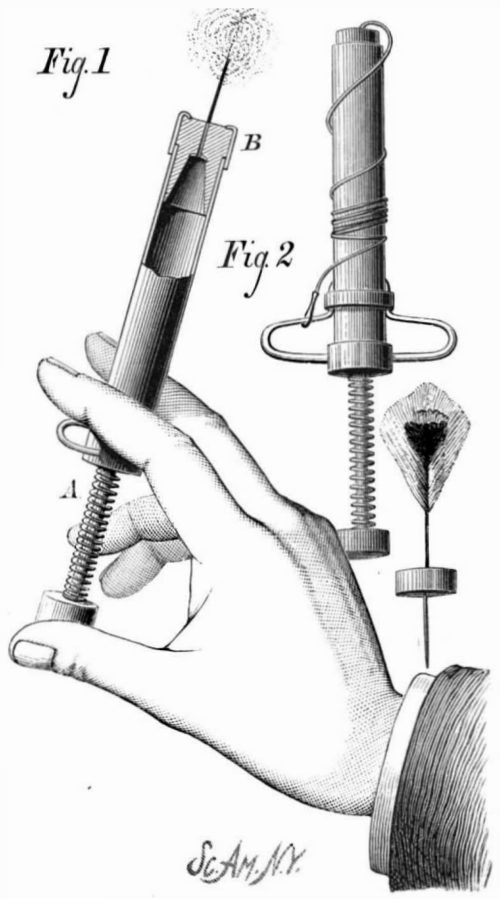
ROOF LINED WITH MINERAL WOOL.

Antidotes to Arsenic.

According to the *Répertoire de Pharmacie*, Rouyer has discovered that, although the freshly precipitated sesquihydrate of iron is an antidote for arsenious acid, it has no effect in counteracting the action of arsenite of soda or of arsenite of potassa (Fowler's solution), but that a mixture of a solution of sesquichloride of iron and the oxide of magnesium will neutralize the effect of these salts, as well as those of arsenious acid itself, and hence this mixture is always preferable in cases of poisoning by arsenic. The officinal solution of sesquichloride of iron should first be administered, and fifteen minutes afterwards the magnesia given in the proportion of 70 grains of the latter to 18 minims of the former. In an hour after the administration of the antidote a cathartic should be given. Lemonade and other acid drinks should be avoided during the treatment, since the compounds formed by the union are insoluble.

IMPROVED INSECT POWDER BLOWER.

The invention herewith illustrated is a new insect powder blower, by which the powder is distributed at will in greater or smaller quantities, and in a minute jet wherever desired.



INSECT POWDER BLOWER.

The device may also be used as a pop gun for children, and as an air gun for projecting a dart at a target. It consists, as shown in Fig. 1, of a barrel in which is a piston, around the rod of which is a coiled spring, A, which serves to retract the piston after the latter has been driven forward by the thumb, the fingers resting on projecting supports. The insect powder is placed in the barrel, and its end is closed by a stopper, B, in which is a perforated disk, the aperture in which regulates the size of the jet of powder forced out. This jet can be directed into crevices or wherever desired.

The arrangement of the device for a pop gun is shown in Fig. 2, the cork being inserted in the open end of the barrel, and forced out by sudden pressure of the piston. The feathered dart used is represented in Fig. 3. Patented through the Scientific American Patent Agency, March 5, 1878. For further particulars address the inventor, Mr. Michael Mark, New York city, N. Y.

Keep Your Mouth Shut.

At the Royal Institution, London, recently, Professor Garrod lectured on the protoplasmic theory of life, and in speaking of respiration drew attention to some few facts of practical importance which, though well known to physiologists, are too often disregarded by the public. The relative time occupied in inspiration and expiration is such that the carbonic acid breathed out to a distance is out of the way before the next inspiration, the air for which is drawn in from the immediate neighborhood of the nostrils. The distance to which breath is exhaled through the nostrils is well illustrated by smoking through the nose. During the day our nostrils are kept clear of interference, as we sit or walk; but at night bed clothing is apt to get so arranged as to retard the current of carbonic acid breathed out, and some of it is thus a second time inhaled, instead of the incurrent being, as it should be, of pure air. Another practical point mentioned was the importance of keeping the mouth closed and of breathing through the nose in cold weather. Air should not reach the lungs at a temperature much below that of the blood, and air is much more warmed in passing through the nose passages than in going directly from the mouth. In speaking of the evolution of carbonic acid, Professor Garrod mentioned a point which, he thought, had not received due recognition, which was that the "protoplasmic" vitality of the body led to the oxidation of pabulum supplied and the consequent formation of carbonic acid, just as muscular work, whether voluntary or not, produced a similar result. Pettenkoffer's experiments with men were illustrated on a small scale, with a tame white mouse, in a glass vessel duly supplied with food, and a current of air so arranged that the carbonic acid breathed out by the mouse was collected in lime water, so that the amount in a given time, and varying with activity or rest, could be estimated.

New Disease among Wool Sorters.

Dr. Bell, of Bradford, England, has directed attention to a new disease among wool sorters, which has been developed since the introduction of mohair and alpaca into the trade. Sudden and unaccountable deaths took place among the workmen, which at length became so frequent as to convert the suspicion into a certainty that something was wrong. Masters and men were equally anxious to understand and prevent the disease. Eminent medical and scientific men have been consulted, and post mortem examinations made, but the cause and nature of the disease were not satisfactorily explained. The symptoms of a typical case might be summarized as follows: No rigor, thirst, pain, vomiting, nor purging; very slight cough; no expectoration; quick breathing, great exhaustion, weak rapid pulse, clear mind, extremities cold, perspiration clammy, gradually decreasing temperature, death in fifteen to twenty-four hours. The medical man is usually at a loss to account for death.

The matter has been fully discussed and a variety of theories suggested, against which an equal number of objections have been made. Dr. Bell's views met with some unanimity. They were as follows: he attributed the evil to the inhalation of a septic poison produced by the decomposition of animal matter in damaged bales, producing septicæmia.

Street Cars Propelled by Compressed Air.

The Second Avenue Railroad, of New York city, has one of the Pneumatic Tramway Engine Company's cars. Upon each platform is a steel lever, by means of which the car can be started, stopped, or its direction reversed. The car is of the same general model as that of ordinary street cars. It has six tubular air receivers situated under the floor of the car. The air is compressed by an engine which is standing at the side of the depot, and is introduced by a rubber hose into these receivers. That air passes through an engine situated between the axles, and propels the car. Sufficient air to enable the car to make the entire circuit of Manhattan Island, if necessary, can be stored at one time in the receivers.

The experiments made have proved completely satisfactory. The car lately ran from 63d to 95th street and back in about twenty minutes, with two or three stoppages. It is claimed for the car thus inspected that it can be stopped more readily than the horse cars, and that its rate of speed can be increased to thirty miles per hour, while it can make nine miles per hour and still not appear to go faster than the horse cars. The car which was run is only a model, and it takes about four hours to charge its receivers with air, but machinery has been ordered which will perform the work in less than a minute.

One of these air engines, it is said, can easily draw a whole train of ordinary street cars. A company composed of twenty-five capitalists has been formed to manufacture cars upon the above model. It has already received an order for five cars from the Second Avenue Company. These will be used on the upper part of the Second Avenue route.

SPIDERS' WEBS.—Leuwenhoek has computed that one hundred of the single threads of a full grown spider are not equal to the diameter of the hair of the human beard; and consequently, if the threads and hair be both round, ten thousand such threads are not larger than such a hair. He calculates that 4,000,000 of a young spider's threads, which are much finer than those of full grown spiders, are not so large as the single human hair.

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THE BOILING LAKE OF DOMINICA.

Dominica, the most mountainous of the Lesser Antilles, is about thirty miles in length by sixteen in breadth. The physical formation of the island is indescribably rugged, and the scenery generally is of the most varied and beautiful character. The highest mountain, Morne Diablotin, is 4,533 feet above the level of the sea, or a little higher than Ben Nevis, in Scotland. There are several large rivers in the island, but its interior is still little known, although nearly 400 years have elapsed since the discovery of the island by Columbus.

A correspondent of the *Illustrated London News* relates the discovery of the boiling lake, and the details of a recent journey to that remarkable place:

"We stood upon a large plateau of about fifty acres in extent, which is in reality a small spur of what have since been called the Sulphur Hills. Here and there over this plateau, on the surface of which is no vestige of vegetation, were huge-charred trunks of trees, large masses of volcanic rock, and numberless blow-holes, ejecting steam and water. The water, collecting from all sides, formed in the center of this scene of desolation a milk-white, impetuous stream, discharging itself over the edge of the plateau into the precipice beneath.

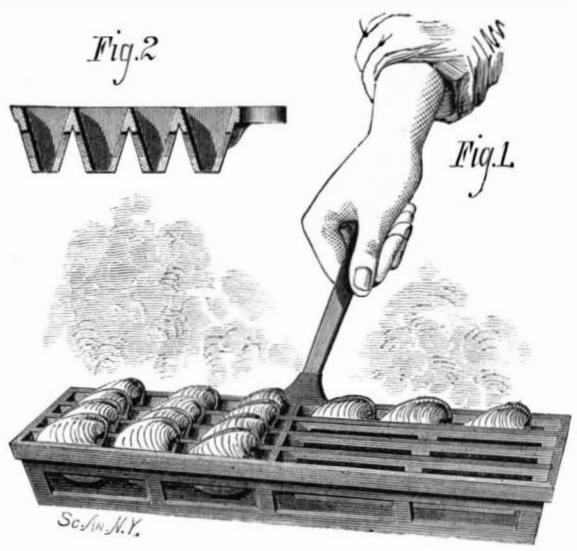
"Picking our way cautiously over this volcanic bed of scoria, pumice, and sulphur, and jumping from rock to rock, which here and there protruded from the stream, we crossed a firm mound of earth beyond, and unexpectedly found ourselves at the edge of the Boiling Lake. It was thus on March 2, 1875, that the Boiling Lake was seen and closely examined by Dr. Freeland, a Scotch medical practitioner, Captain Gardyne, who was traveling with him, Dr. Nicholls, a medical practitioner in this island, and myself.

" Here, then, at an elevation of about 2,400 feet above the level of the sea, and on the southern side of the Sulphur Hills, is the Boiling Lake of Dominica. It is a body of pale slate-colored boiling water, inclosed in a circular basin of about 150 yards in width, the sides of the basin being, I should say, about 60 feet in height. The bare summits of the Sulphur Hills rise about 500 feet above the edge of the basin, and from blow-holes in the side of the hills issue small quantities of water, which in their downward course to the lake form two tributary rivulets.

"On arriving at the edge of the basin one sees nothing but clouds of steam rising from the lake. But the noise of the boiling water is distinctly audible, and it is only when a passing breeze for a moment dissipates the cloud of steam that one sees boiling in vast bubbles the body of water at one's feet. The actually boiling portion of the lake must be in a circle of about 40 feet in diameter, and the bubbles rise, I should say, about 3 feet or 4 feet into the air. The ripples caused by the boiling break towards the surrounding shore until they lave the sulphur-coated stones at the water's edge. The water itself, it is curious to observe, has, near the shore, a circular motion, which, perhaps, to some extent, accounts for the shape of the lake's basin; for I noticed that a small log thrown into the water traveled round the lake, passing and repassing the spot at which it had entered the water. The only apparent exit to the lake is on the southwestern side, and is not unlike a railway cutting—say about 9 feet in width. The amount of water discharged through this exit is apparently very small; but on closer examination I noticed an extensive sub-surface drainage, which, at about 200 yards south of the lake, forms a beautiful waterfall."

IMPROVED CLAM BAKER.

The implement illustrated herewith is a handy contrivance for baking clams in their shells. It holds the clams so that all the juice is retained, and enables the baking to be more expeditiously and conveniently done. The device consists simply of a rectangular iron frame, the sides of which are downwardly and inwardly inclined, so that the bottom is narrower than the top. In said frame are arranged V-shaped bars, as shown in Fig 2, which have cavities in their under sides, so that the heat is more quickly distributed to the clams when placed over the fire. This construction also allows of the implement being cheaply made of sheet metal.



STROUB'S CLAM BAKER.

In use the clams are placed as shown in Fig. 1, with the edge or mouth of the shell downward and wedged in between the bars, so that the bivalve cannot open while being cooked. The whole is then placed over the fire, and left without further attention until the baking is accomplished. Patented January 22, 1878. For further particulars address the inventor, Mr. John L. Stroub, New York city, N. Y.

Charles Frederick Hartt.

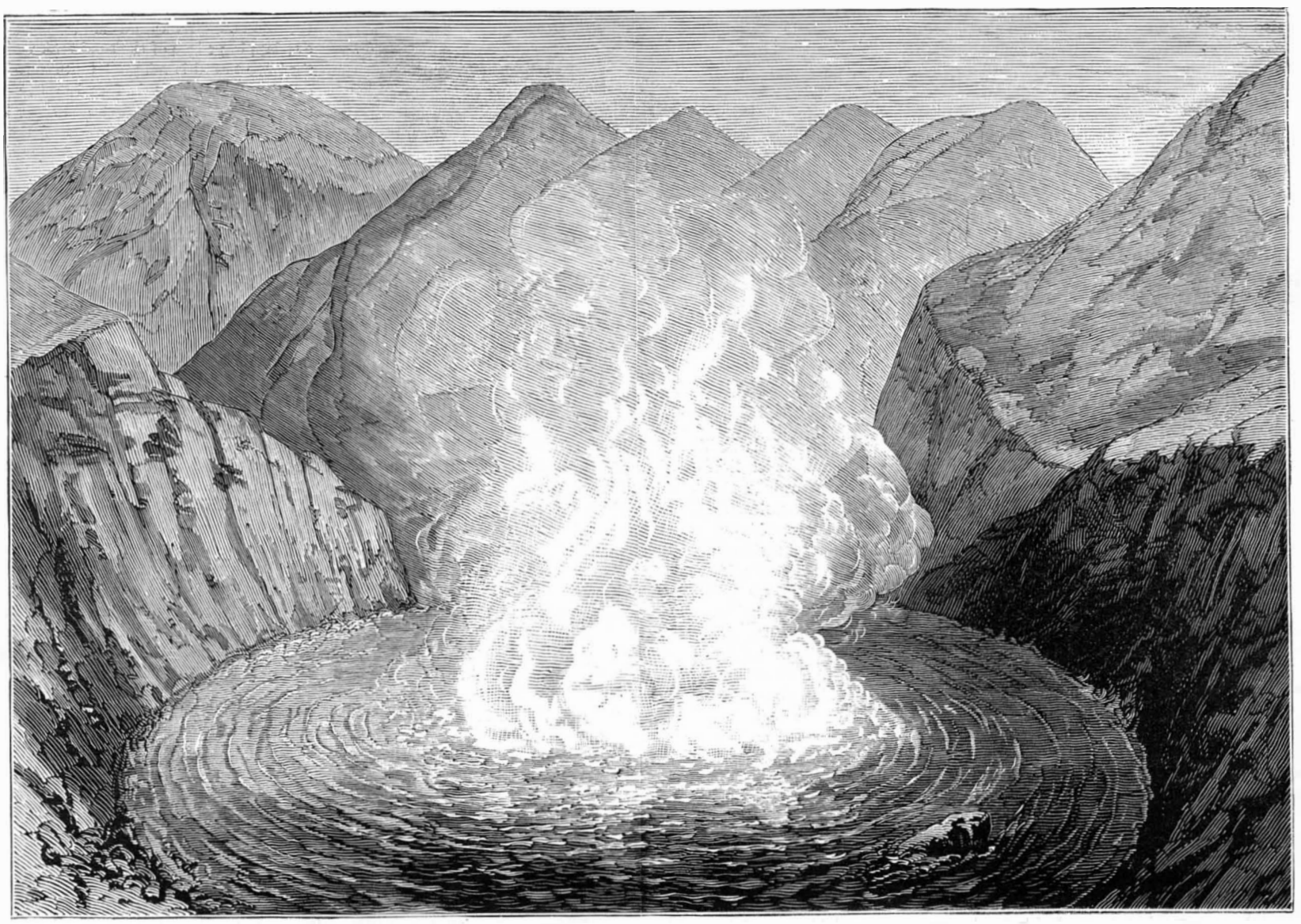
The loss which the world of science, but a few months ago, suffered in the death of Professor Orton, while engaged in South American exploration, has recently been supplemented by that of Professor Charles F. Hartt, Chief of the Geological Survey of Brazil. Professor Hartt was born about 1838, at St. John, N. B. In his youth he became interested in the study of geology, and discovered at St. John many new fossil plants and the oldest specimens of fossil insects then known. Most, if not all, of these were named and described by him in Dawson's "Arcadian Geology." From 1862 to 1865 he studied under Agassiz, and accompanied the latter to Brazil as geologist of his expedition. Shortly after his return he succeeded Professor Tenney to the chair of Natural History of Vassar College, which he resigned to accept the Professorship of Geology and Physical Geography at Cornell University. From the time of his first visit to Brazil, he made the geology of that empire his special study, and returned thither three times; in each case making careful explorations of the northern provinces and the valley of the Amazon. In May, 1875, the Emperor placed Professor Hartt at the head of the Geological Survey of Brazil, with a most liberal salary. The results of this great work have been but partially published. He was an untiring worker, and the results of his labors, although extensive, might have been still more so had he not been hampered through the jealousy of his native assistants during the absence of the Emperor in America and Europe. In 1870 he published his chief work "The Geology and Physical Geography of Brazil."

It is rarely that we find a specialist so versatile as was Professor Hartt. To his accomplishments as a geologist were added those of an ardent archæologist, artist, and linguist. He learned a new language with amazing rapidity, and the idiom of his adopted country was as familiar to him as that of the land of his birth; while his researches into the structure and affinities of the Indian languages of South America were profound and accurate. It is a singular fact that in the death of Professor Hartt, Vassar College loses, within a year, the only three professors who have filled the chair of Natural History in that institution, the other two being Sanborn Tenney and James Orton.

To Exterminate the Red Ant.

Professor Leidy states that when he purchased his present residence, while it was undergoing repair, he noticed a fragment of bread, left by the workmen in one of the second story rooms, swarming with little red ants.

Apprehending that the house was seriously infested, to ascertain whether it was so, he placed a piece of sweet cake in every room from the cellar to the attic. At noon every piece was found covered with the ants. Having provided a cup of turpentine oil, each piece was picked up with forceps, and the ants tapped into the oil. The cake was replaced, and in the evening was found covered with ants. The same process was gone through the following two days, morning,



THE BOILING LAKE OF DOMINICA, WEST INDIES.

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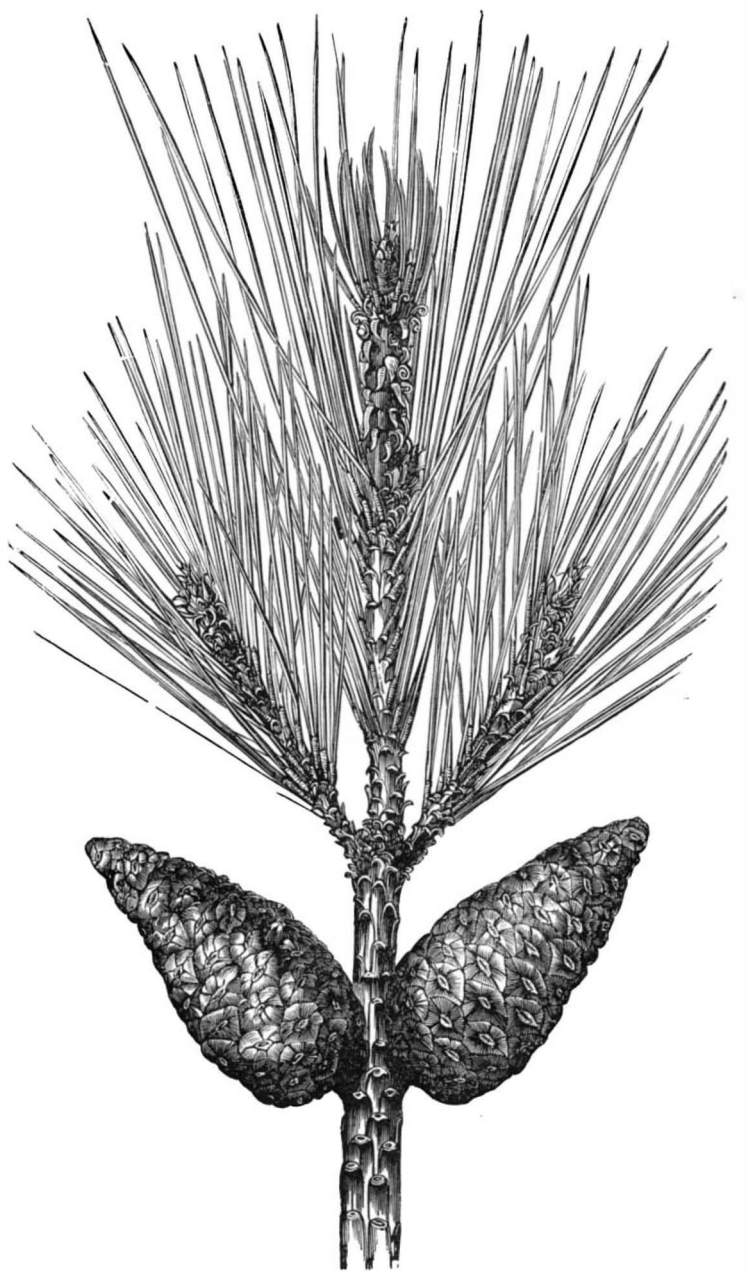
noon, and night. The third day the number of ants had greatly diminished, and on the fourth there were none. He at once concluded the ants had all been destroyed, but in the attics he found a few feeding on dead house flies, which led him to suppose that the remainder had become suspicious of the sweet cake. He accordingly distributed through the house pieces of bacon, which were afterwards found swarming with ants. This was repeated with the same result for several days, when, in like manner with the cake, the ants finally ceased to visit the bacon. Pieces of cheese were next tried, with the same results, but with an undoubted thinning in the multitude of ants. When the cheese proved no longer attractive, recollecting the feast on dead flies in the attic, dead grasshoppers were supplied from the garden. These again proved too much for the ants, and after a few days' trial neither grasshoppers nor anything else attracted them. They appear to have been thoroughly exterminated, nor has the house since been infested with them. Professor Leidy regards the action of the ants as indicating a ready disposition to become circumspect.

THE PYRENEAN PINE.

The foliage of this tree is very distinct, quite unlike that of any other conifer. The leaves are in twos, of a beautiful grass-green color, and from 6 inches to 7 inches in length. It can easily be distinguished from other pines on account of the deep yellow colored bark on its young shoots; the cones are about 2½ inches long, rather egg-shaped, on short footstalks, sometimes in twos, but mostly solitary. It is found on the Pyrenean mountains, where it forms extensive forests. This tree is highly ornamental, especially when young, its fine, upright-growing, light green leaves, and the orange colored bark on the terminal shoots being its most striking and beautiful features during that stage; but when older, it assumes a coarser habit of growth; its branches become stout, wide-spreading, and straggling, and altogether its general appearance is far from attractive. This pine has never been very extensively planted, on account of its scarce use in the trades, and the difficulty in procuring seed true to name. The wood is of inferior quality. We copy the illustration from the *Garden*.



THE PYRENEAN PINE.

Presence of Indigo in the Human System.

At a recent meeting of the Pathological Society, of London, Dr. Ord exhibited a specimen of a renal calculus containing indigo. He remarked that indigo, as well as a substance which yielded indigo blue under certain reagents, was sometimes met with in normal urine; but it had never before been met with in the form of a calculus. The specimen consisted of a black mass of the size of a half walnut, lodged in the pelvis of one of the kidneys. When heated on platinum foil it gave off a peculiar smoke, which had a sooty character; after incineration a small amount of a deposit of phosphate of lime was left behind. With the microscope, bluish-black masses and crystals could be seen; and after treatment with hydrochloric acid a black residue was obtained. On sublimation it yielded crystals in the form of six-sided tablets, just like indigo. After trituration with strong sulphuric acid, it gave a blue fluid, which finally had the spectroscopic characters of indigo, a single broad absorption band in the yellow and orange part of the spectrum. In regard to the formation of the substance, Dr. Ord stated that there had been nothing peculiar in the patient's food to produce it. Indol, which bears some relation to indigo, is formed by the action of the pancreatic juice and pepsones, and is present in the fæces. When indol is injected into the blood of a dog, indican appears in the urine. Now indican, richer in carbon and hydrogen than indigo, is decomposed by the action of acids into a mixture of indigo blue and glucine; and hence it is said that in this is to be found the reason of the presence of indigo in the urine of cholera, and in cases of obstruction of the passage of the fæces through the intestine. It is also found in pus, the greenish blue color of which is due to a substance allied to indigo. In the present case, pus contained in one of the kidneys may have been the source of the indican, which, being reabsorbed by the blood, was excreted by the other kidney, and precipitated as the colored indigo-blue by its contact with the acid urine. Whatever the explanation, it pointed to a direction in which the urine might be studied with profit. Dr. Thudicum remarked that the first urine of cholera contains a very large quantity of indican, so that the albumen in the urine is precipitated of a black color. But even if a substance was present only in a small amount, it was not, therefore, to be regarded of no importance, but the contrary.

RECENT experiments by Professor McNab on the rate of the ascent of fluids in plants, ascertained by the employment of spectroscopic examination of the diffusion of lithium citrate, gave a maximum result of 24 inches per hour

THE OIL BEARING SANDS OF PENNSYLVANIA.

The question as to the precise spot in which a well may be sunk with a sure prospect of "striking oil" is one of great importance to petroleum miners, and yet one which the most experienced and best informed oil men fail to answer with certainty; and, in fact, one that must await the completion of the present geological survey of Pennsylvania for its correct solution. Pending this result, however, Mr. Ashburner, one of the assistants of the survey, has, in a paper read before the Engineers' Club, of Philadelphia, given us some valuable information as to the rock formations and the relative positions of all the oil horizons of Western Pennsylvania, together with an estimate of the daily production of each horizon. That portion of the State in which petroleum has been found lies entirely west of a line drawn across the State, from its boundary at the southeastern corner of Greene County, to that at the northeastern corner of McKean County. The oil regions may be divided, for convenience of description, into three districts, the southwestern, the western, and the northern.

The southwestern district may be said to include that part of the State south of the Ohio river and west of the Monongahela river; the western, known among the producers as the "lower country," lies in the water basin of the Allegheny river, between Pittsburg on the south and the Philadelphia and Erie Railroad on the north; and the third, or northern district, lies entirely north of the Philadelphia and Erie Railroad, in the counties of Warren and McKean, and extends ten miles into the State of New York.

The strata of Western Pennsylvania lie comparatively horizontal, and their average dip from Bradford, near the State line, to Pittsburg, is about eighteen feet to the mile. Three thousand feet of the stratified rocks of the Carboniferous and Devonian ages in Pennsylvania have been found to contain petroleum. The highest stratum in which oil is found occurs in the coal measures, 165 feet below the Pittsburg coal seam, in Greene County; while the lowest occurs about 3,200 feet below the geological position of the Pittsburg coal seam in McKean County. If we should drill a well in Greene County 3,200 feet deep, starting on the Pittsburg coal, we would pass through the horizon of all the sands and sandstones in which the petroleum of the State has been found. The rocks are subject to very marked and rapid changes in their thicknesses, in comparatively short distances. What the changes in thickness may prove to be between McKean and Greene counties is not yet known; nor is it easy to say whether the total thickness of the stratified rocks between the Pittsburg coal and the "Sartwell" (or lowest) horizon will be found of a variable quantity, or much greater or much less than the above estimate at localities between the two counties.

The petroleum in the southwestern district comes from the highest rocks. The "oil-sand group" of this district is about 800 feet thick, and is composed of three sandstone members, separated by intervals containing coal seams, slates, and shales. The first, or upper, oil sandstone, 260 feet thick, shows considerable variation, and is often replaced by shale; in such cases the shale contains no oil. The second, or Mahoning, sandstone is quite constant in thickness, 135 feet being the average. It is the principal repository of the petroleum of the southwestern district. The third, or lower, sandstone is made up of three members, separated by about thirty or forty feet of shale and coal. The thickness of the whole is about 400 feet. The upper member is regarded as the oil bearing rock; the lower is the representative of the coal conglomerate or millstone grit. Some of the features of this district are very different from those of the other two. Small crevices in the oil sands are of frequent occurrence; and it is a striking fact that the oil is said never to have been found except where a crevice has been so struck. By some this feature has been considered a necessary one to the original production of the oil. Professor Stevenson, however, states that the oil in nowise owes its origin to a disturbance of the strata, but that the only effect of the latter has been to provide reservoirs for the oil in the rock already oil bearing. Between the bottom of the coal conglomerate (the lowest member of the lowest oil-producing sandstone of the district under consideration) and the "first oil sand" (the highest producing sandstone of the western district) there is an interval of from 650 to 700 feet of shales and sandstones, forming the barren oil measures, or mountain sand group. These rocks are perfectly destitute of any economical strata, containing no coal, iron, or oil.

The petroleum producing sands of the western district are found intermediate between the high rocks of the southwestern district and the low rocks of the northern. The total thickness of the group is 315 feet, and consists of three strata separated by two intervals of 105 feet and 110 feet respectively. The first sand produces a heavy lubricating oil, of from 30° to 35° gravity; the second, an oil of about 40°; and the third, the usual light oil, of from 45° to 50° gravity. The latter sand is the most productive, and yields most of the oil of commerce. The well records along the "green oil belt," in Venango County, show great uniformity in the arrangement of the sand rocks, being sharply defined, massive, and lying at regular intervals. Going southeast from this belt, they gradually split into several members, becoming finer and finer in their composition, and shade off into shales. Going to the northwest, the third sand terminates quite abruptly; the second sand overlaps it and continues a mile or two farther; the first sand overlaps the second, and extends in some places a long distance beyond. Most of the wells producing from the first and second sands are located along these overlapping edges of the sand rocks. Wherever the lowest sand is adapted to the production of oil, the main deposit is found in it, and not in the sands above. The first and second sands do not produce oil along the center of the belt. In some wells oil has been obtained from all three of the sands; but in such cases the wells are not on the axis, but near the edge of the third sand; and but a short distance farther from the center no third sand can be found. These facts are suggestive, and seem to point to the conclusion that the oil sands are merely reservoirs which have acted as sponges in absorbing the oil that has ascended from a much greater depth. In such a case the oil would not be a product of the rock in which it is found.

The petroleum of the northern district comes from the lowest rocks. Between the "third oil sand" of the western district and the Warren sand of the northern district there is an interval of about 600 feet of shale, which is entirely barren. The Warren oil sand is very irregular in character, and the oil is found at horizons varying from 600 to 800 feet below the Venango third sand. In quality it very much resembles the "third sand oil." By many of the producers it is known as "slush oil," on account of the poor quality of the sand, and the rapid diminution of the product of the wells, which yield largely when first struck. The productive horizon of the Bradford oil belt in McKean County and Cattaraugus County, N. Y., occurs probably 300 feet, more or less, below the Warren horizon. The sand in this belt is of a finer and closer texture, and is more constant in character over a wide area than that of any other producing belt in Pennsylvania. This belt is the surest and safest territory in which to operate. The oil is of about the same gravity as that of the "third sand oil," but somewhat different in character. On account of these differences in the sand and oil, the Bradford wells are never pumped continuously, but "by heads," or at regular intervals. This is found necessary to keep the sand open or porous. A great deal of the oil obtained from the Bradford belt, along the State line, is found several hundred feet above the regular producing sand. The lowest oil of the northern district, and in fact in Pennsylvania, comes from the "Sartwell oil sand," but recently discovered in Liberty Township, McKean County.

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This horizon is probably 400 feet below the Bradford sand, and has not yet been tested thoroughly. At present it is non-productive.

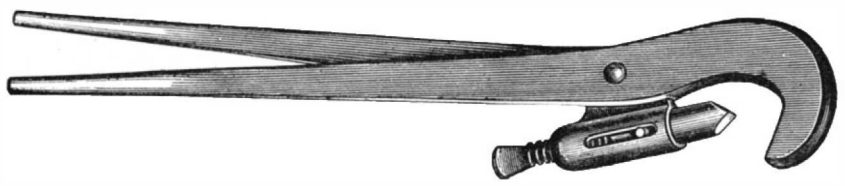
Petroleum has never been found in the three groups of oil measures in the same locality. Since the oil sands of the southwestern and western districts come to the surface in the northern district, we may never expect to find oil in them north of the Philadelphia and Erie Railroad. The question as to whether the northern district oil will ever be found in the western district, and the oil of both these districts in the southwestern district, is yet to be determined. If future explorations should prove this to be the case, it is safe to assert that, at the present price of crude oil, the wells would be too deep and too expensive to warrant their development.

IMPROVED PIPE TONGS.

We illustrate herewith an improved adjustable pipe tongs, so made that no smith's work is needed for dressing up, a few minutes' grinding being all that is required to keep the implement in good working order.

The gripping edge consists of a cylindrical piece of best cast steel, which is quickly adjusted to the pipe by the thumbscrew, and which, as shown in the illustration, has two edges. When the edge in use has become dull, the bit can be reversed, and it will be found that the friction on the lower edge has sharpened the one not hitherto used. The bits are easily removed, and may be re-ground until worn away, when they can be replaced by any mechanic, being simply pieces of round cast steel with an obtuse chisel edge. The thumbscrews have square threads, and are case-hardened to insure durability and prevent spreading at the point, and generally the tool is made in an excellent and substantial manner.

For further particulars address the manufacturers, Messrs. Pancoast & Maule, 243 and 245 South Third street, Philadelphia, Pa.



THORNTON'S ADJUSTABLE PIPE TONGS.

IMPROVED RECEIVER AND STENCH TRAP.

We illustrate herewith a new receiver and stench trap, made of cast iron, and fixed upon a level with the street gutter. It is connected with the sewer, and constructed as follows: A is a basin which is always full of water to the level of the bottom of the sewer, B. C is a door dipping three inches into the water in the basin, and resting upon a flange each side and along the top. Upon this flange packing is laid, and the door is closed and compressed upon the packing and flanges by a crossbar, D, which is forced by an inclined plane against the door. The door thus aids in forming a trap, which prevents the escape of any foul gas from the sewer into the street. The earth being excavated to the shape of the outside of the receiver box, the latter is lowered and fixed in its proper place, level with the gutter; and grout, composed of sand and hydraulic cement, is poured underneath and around the bottom, giving to the basin a firm bed. The space between the sides and ends of the receiver box is filled in with concrete.

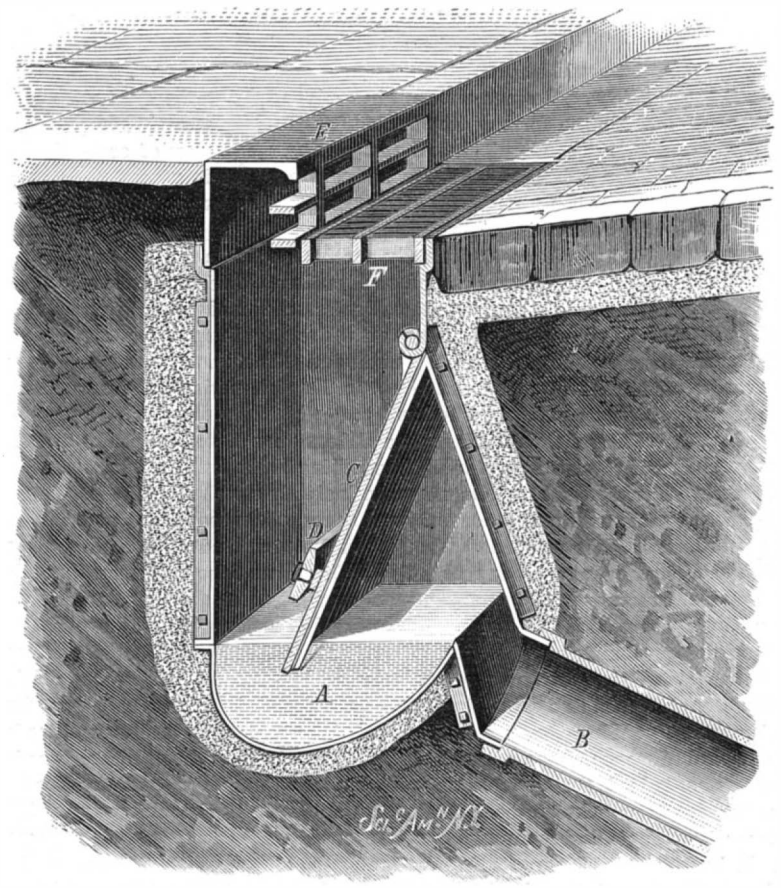
The street gutter is covered with a flat cast iron grate, F, which conducts the water from the street gutter into the receiver box. The grate, E, is fixed in the line level with the top part of the curbing, and is anchored at both ends on the top into the curbstone, and also on each side of the cast iron receiver.

In case the flat grate gets choked with leaves and street washing, the water will pass through the upright grate into the receiver box, thereby preventing the overflow of the street with water. That part of the receiver underneath the sidewalk is covered with a cast iron plate, connected with the horizontal grate.

The receiver is constructed in such a manner as to be self-cleansing. The front end being made at an angle, and that part of the basin which receives the water near the bottom of the door being contracted to equal the size of a fifteen inch sewer, the water, falling four feet from the level of the street gutter to the level of the water in the basin, will force all the sand and silt out of the trap and wash it through the sewer.

In order to take out obstructions and clean the sewer, it is necessary to remove the crossbar, D, and open the door or trap; when this is done, by using rods about four feet long, each with union joints, any tool necessary for cleaning the sewer may be connected to the rods, and the sewer can be cleansed from the receiver box to its connection with the main without breaking up the street.

The device is stated in numerous testimonials by city engineers and others to be exceedingly efficient in operation, and effectually to prevent any escape of sewer gas. For further particulars as to rights, etc., address the inventor, Mr. Thomas Dark, 408 North Division street, Buffalo, N. Y.



DARK'S CAST IRON RECEIVER AND STENCH TRAP.

THE ordinary work of a horse is stated at 22,500 lbs. raised one foot in a minute for eight hours a day.

INFLUENCE OF COSMICAL MATTER.

Some weeks ago we noticed Professor Doolittle's suggestion that shooting stars may have played an important part in determining planetary velocities. Immediately Professor Winchell entered a claim of priority, and sustained it by citations from a lecture delivered last December. Professor Doolittle promptly acknowledged the justness of the claim, but insisted that he was first in the deduction of consequences and relations. "So far as I can learn," he wrote, "Professor Winchell has the honor of having been the first to furnish a demonstration thereof whose soundness no scientific man can question. I think, however, that I may fairly claim to have preceded him in forming an approach to a proper estimate of its importance. Otherwise, I should regard him as inexcusable for having dismissed the subject with so brief a paragraph in a popular lecture, without making any other attempt to bring it to the attention of the scientific world."

Professor Doolittle "formed the conception of aerolithic acceleration of planetary velocities" in February last: Professor Winchell announced the same conception in December, 1877. Now there arises a new claimant in the person of Rev. S. Parsons, who discussed the same idea in an article on the nebular hypothesis, in the *Methodist Quarterly*, January, 1877. While showing that cosmical dust must, in the course of ages, present a sensible resistance to the motion of bodies through the universe, Mr. Parsons said:

"Professor Newton, of Yale College, estimates the number of shooting stars encountered by the earth during each year at about 400,000,000 (not for each day as Professor Winchell states). Calculations based on their apparent magnitude, as viewed from different points of the earth's surface, give them a diameter ranging from 80 to 120 feet. Supposing their density to be the same as hydrogen, the lightest known substance, the earth during the past 100,000,000 years has encountered and absorbed into itself a mass of matter equal to about one twelve thousandth ($\frac{1}{12184}$) of its own mass. Such an amount of resistance would be sufficient to change the earth's orbit from an extreme oval into its present shape, since in addition to diminishing the mean distance, and accelerating the velocity, the effect of the resisting medium is much greater in aphelion when the motion is slower, than it is in perihelion."

The history of this conception is worth preserving, since it is one of the most important of recent contributions to the science of astronomy. According to Professor Doolittle it helps to furnish the most satisfactory explanation of the following classes of phenomena: 1. The want of coincidence between the solar equatorial plane and the planetary orbital and equatorial planes. 2. The eccentricities of the planetary orbits. 3. The position of the inner moon of Mars. 4. The irregularities of the periods of Encke's comet.

From the shifting of the planetary planes, Professor Doolittle estimates that the earth, so far from being born full-grown, has more than doubled its mass since it commenced its career; but from geological considerations it must be supposed that by far the greater part of this acquisition was made before it solidified into a record-keeping condition. While geological confirmation of the theory is, therefore, not essential, it is still very desirable; and he infers that the theory will add new interest, and, perhaps, to some extent, give new direction to geological investigation.

American Horses in England.

The exportation of horses from this country to England, for use on street railways, began two years ago, and already over 5,000 of the Canadian and Morgan breeds have been shipped from this port and from Quebec. The English cart horse is too heavy and slow for tramway service, and as English breeders have given their attention almost exclusively to cart horses and blooded saddle and coach horses, they could furnish no animals suitable for the new want. The supply of light-built and enduring horses had been drawn chiefly from Ireland, but this source is almost exhausted. The American horses were at first used only on street railways, but they are now becoming favorites for family use. The Anglo-Russian complications have largely increased the demand this year, and it is expected that the exportation will amount to many thousands more than ever before.

New Agricultural Inventions.

Mr. W. K. Hill, of Brush Creek, Iowa, has patented a convenient apparatus for Cooking Feed with Steam, which is claimed to be especially economical of fuel. The fire chamber is entirely surrounded by water except at its door, the feed water is warmed before entering the steamer, and the supply is regulated automatically by a float valve.

A portable Scale for Weighing Bales has been patented by Mr. G. R. Williams, of Dardanelle, Ark. It is a beam scale suspended from the center of a yoke-shaped axle of the supporting wheels. From the beam are suspended, by crossbar and chains, V-shaped hooks, which take hold of the bale and are operated by guiding cords. The bale is raised by depressing the handle frame of the apparatus, the leverage rendering this easy.

Mr. G. C. Clark, of Freehold, N. Y., has patented an Improved Horse Potato Fork, consisting of a head attached to a tongue, and provided with adjustable teeth, and with spring catches for securing the handles of the implement to the head.

Mr. A. A. Russell, of Polo, Ill., has invented an Implement for Cleaning Horses, which is made by uniting a horse brush and currycomb in such a manner that the teeth of the currycomb may be caused at will to project beyond the face of the brush, by pressure applied by the fingers of the hand by which the brush is held and operated. Thus the comb may be brought into action whenever desired, and applied gently or forcibly. There is also a cleaning device in connection with the brush.

Mr. Jacob Künstler, of Thomas Hill, Mo., has invented an instrument for Paring Horses' Hoofs. It consists of a pair of hinged jaws, one ending in an arm, which rests against the hoof, and the other in a knife of suitable shape, and operated by lever handles.

Mr. E. J. Camp, of Alpharetta, Ga., has made an improvement upon the Plow forming the subject of letters patent No. 58,119. The invention consists in the construction of the standards, by which they may be attached to the beam on different sides, and thus adapt the plow for use as a subsoiler, or for "breaking up," and other purposes.

In a new Cultivator, the invention of Mr. T. J. Brown, of Fairfield, Texas, the essential feature, a circular rotating frame, carrying plows and rollers on caster wheels, is supported in guides in the main frame, and is directly attached to the tongue, so as to turn with it.

An improved Seed Planter, invented by Mr. T. B. Swan, is claimed to possess important advantages, among which is its adaptability for use in planting seeds of different sizes and kinds.

Mr. Benjamin Slusser, of Sidney, O., has patented an improved Earth Scraper, the novel feature of which consists in arranging the forward end of the handle in a socket attached to the scraper, and fastening the handle by a clamp, which is also attached to the extended ends of the tie rod, which holds together the sides of the scraper.

A Revolving Earth Scraper, patented by the same inventor, possesses some new points, designed to lessen the liability to revolve and empty itself while being filled or transported. The scraper is pivoted to the handles well back and near its center of burden, and right angled catches are attached to the rear ends of the bail, which operate in conjunction with two circular locking irons on the forward sides of the scraper, so that the scraper cannot revolve until the position of the handle is so changed at the will of the driver as to effect the disengagement of the locking devices.

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PROPOSED INJUSTICE TO INVENTORS.

In a recent article on Section 11 of the proposed amendment to the patent law we referred to the injustice of compelling inventors to pay a second time fortheir patents at the end of four years, or else forfeit all rights they may have acquired in their inventions. We now propose to show how such a clause might have robbed some of the greatest benefactors of the human race of all means of profiting by their inventions had such a clause been in existence at the time of the granting of their patents.

Take, for instance, the case of Watt. Although he commenced his labors in connection with the improvement of the steam engine in 1763, it was not until 1769 that he obtained his patent, and it was nearly six years after its issue before he succeeded in making a working engine which gave satisfaction, having in the mean time spent all his own means. At the end of this six years his prospects were then so doubtful that although eight years of the life of his patent remained, yet he could find no capitalist who would embark sufficient means to carry on the business of manufacturing until he succeeded by some means in inducing Parliament to extend his grant for an additional ten years. Is it not possible that under the modern English system of fees, which it is now proposed to graft on to our law, the payment of an additional tax at the end of four years, when Watt was discouraged with repeated failures, might have been the "last straw" which we so often hear about?

As another example, take the case of Elias Howe, Jr., the inventor of the sewing machine. His invention was patented in 1846, but it was not until after 1853 that he succeeded in making anything by his invention, and he would not have been able to do so then but from the fact that his father mortgaged his homestead to raise money to begin a law suit against infringers. To give an idea of his poverty previous to this time it may be stated that although his wife was dying of consumption at Cambridgeport he could not go to see her until his father had sent him money to pay his fare from New York to his wife's death bed. He did not even have his patent in his possession at this time, it being pawned for a hundred dollars. And yet under the proposed amendment (?) he would have been called upon at this time to pay $50 or lose his patent. Could anything be more unjust?

Goodyear may be cited as another instance of how such a tax would work. Although he was the owner of a patent on the combination of sulphur with rubber, it was not for many years after that he succeeded in bringing the invention into practical use, after a long series of experiments, which beggared him and brought him so low financially that himself and family were frequently without food. How could a man in this condition pay an additional tax of $50 to keep his patent alive, when he could hardly find food to keep body and soul together?

As another instance of the difficulties inventors have to contend with after their patents are granted, Bessemer's invention may be cited. The foundation of the patent of the Bessemer process was granted in 1856; it was not until 1863 that the process was commercially successful; and it was even then doubtful, and for several years after it was still considered so, for it was not until 1869 that the Hon. A. S. Hewitt, one of the members of Congress who will have to vote on this bill, and a very prominent and intelligent iron master, who had watched the growth of the invention very carefully, considered that it was so far successful as to warrant its introduction into America, although other gentlemen with greater faith in its success had introduced the process here some years earlier. Bessemer was a wealthy man, and had access to the plethoric pocketbooks of some of the richest English capitalists and iron masters, and he was therefore able to keep up his payments on his English patents, so that he and his backers finally reaped an abundant reward. But supposing him to have been a poor man, as the majority of inventors are, and without the aid of the capital which Bessemer's connections gave him, is it not more than probable that the tax on his English patent would have been the cause of his abandoning his invention, thereby cutting off all possibility of his reaping any advantage from it? In this case, not only would he have lost his reward, but the world would have lost the benefit of the Bessemer process of making steel, for without Bessemer's indomitable perseverance the process would have been given up long ago, and we should have to pay $200 per ton for steel instead of about $45 per ton, as at present.

But, it may be objected, these are all supposititious cases. Let us, therefore, cite a case that actually occurred, where one of our benefactors has actually been robbed of his reward because he happened to be poor. The Bessemer process as originally patented was not a practical working success, as above stated, and many difficulties had to be overcome before such practical success was reached. Mr. Robert Mushet, of Cheltenham, England, succeeded in breaking down one of these difficulties by the introduction into the molten Bessemer metal of from one to five per centum of "spiegeleisen," a compound of manganese, iron, and carbon. This he patented in 1856, but from the cost of his experiments he became embarrassed and had to put his patent into the hands of trustees; and the apparent failure of the Bessemer process (upon which his was dependent) led the parties who were holding his patent in trust for him to think it not worth while to pay the additional tax when it became due, and Mushet himself was too poor to do so. Under these circumstances, which will be the case with thousands of struggling and meritorious inventors should the iniquitous Section 11 become law, Mushet's patent became public property, and although every pound of Bessemer steel is made in accordance with Mushet's process he received no reward, having lost it through the imposition of the tax called for under the European system, which it is now proposed to add to ours.

Many other instances could be given where the inventors have had a long struggle with poverty before they succeeded in reaping their desired reward, had we time to hunt up the data and space to print them, but we think sufficient has been stated to show how badly this Section 11 would work in practice. Inventors under the most favorable circumstances, with a very few exceptions, have a hard time of it; and Congress should pass laws that would encourage them, rather than such as would rob them of one of their chances of reward. For even after an inventor has succeeded in benefiting himself as well as the world, and is apparently in the receipt of a good income, litigation steps in, and robs him of the lion's share of his reward, as in the case of Goodyear, who, in the height of his apparent prosperity, was, as the result of litigation to enforce his rights, cast into prison for debt, and while in prison received the mockery of the Cross of the Legion of Honor from the Emperor of the French.

Flour Mill Explosions.

Although theories had been previously constructed to account for the phenomena of flour mill explosions, the subject was first brought into prominence in 1872 by the explosion of the Tradeston Mills, at Glasgow, Scotland. Destructive fires had before that date happened in different parts of Germany, but the appalling magnitude of the disaster that overtook the Tradeston Mills in July, 1872, at once elicited a general discussion and attracted the notice of scientists. The insurance companies at first refused to pay the insurance on the property, but afterwards paid the full amount, as it was known that the causes leading to the explosion were not within the control of the owners of the mill. A similar explosion occurred at the City Mills, at Port Dundas, Scotland, on September 15, 1874, attended with less disastrous results; but it served to keep fresh in the minds of the British people the possibility of explosions taking place, even in such peaceful establishments as flour mills. The first opinion as to the cause of these phenomena which we shall notice is that of Dr. W. Smith, of Manchester, England, who gave considerable attention to the subject. He relates how an explosion was produced in the Ofen-Pesth steam mill at Budapest, Hungary, which blew off the roof of the building and caused other damage, by workmen mixing some fine varieties of flour. The door of the mixing room was left open, and a thick cloud of dust became ignited from a light. A similar explosion took place at Friedict, Germany.

Dr. Smith states his opinion as follows: "It has been demonstrated that flour and bran intimately mixed, and in a fine state of division, gives off a gas at 450° Fah., which, when mixed with nine volumes of air, forms an explosive mixture, liable at any time to be fired by a spark or flame." He recommends that the use of exposed portable lights in mills should be prohibited.

Wiebe, a German chemist, has advanced the theory that grain in the form of impalpable flour undergoes rapid combustion when ignited, and that during the process of combustion a highly explosive hydrocarbon gas is generated, which, when mixed with air, becomes highly explosive. We shall notice this opinion further on.

Perhaps the most generally received opinion is that advanced by Professor Stevenson Macadam. When the Tradeston Mill explosion took place, Professors Macadam and Rankine were requested to take an active part in investigating the causes that led to the explosion. Professor Macadam published his views in *Iron*, an English periodical, from which we extract the following:

"The chemistry of grain and flour may assist us in arriving at an understanding regarding these fire explosions. The chemical components are principally starch and gluten, with small proportions of gum, sugar, oil, woody fiber, and ash. The starch and woody fiber are composed of carbon, hydrogen and oxygen ($C_6H_{10}O_5$); so are also the gum, sugar, and oil; and the gluten contains these elements, accompanied by nitrogen, sulphur and phosphorus. All these proximate constituents are combustible when burned in the ordinary way, and are consumed with greater rapidity when diffused as a cloud through the air.

"When the flour is showered from a sieve placed some distance above a gas flame, rapid combustion takes place; indeed the flour burns with explosive rapidity, and the flame licks up the flour shower somewhat in the same way that it flashes through a mixture of gas and air, or that it travels along a train of gunpowder. Similarly, the flour, blown into a cloud by a pair of bellows, at once takes fire and burns with a sudden and vivid flash. The smut taken from the grain during cleansing, and the shorts separated from the flour, burn with equal readiness.

"Probably the best way of showing the explosive combustibility of flour particles is to place some flour in a box lying inverted on its lid, introduce a light, and blow the flour into a cloud by bellows, when instantly the box is lifted from its lid and much flame rushes out. The fine division of the flour has necessarily much to do with the rapid combustion; and, indeed, coarse gunpowder can be passed through a flame without burning, while iron filings cannot fall through the same flame without being set fire to.

"When bruised, the flour resolves itself into gases. The carbon, by uniting with the oxygen of the air, becomes carbonic oxide (CO), or carbonic acid (CO_2), and the hydrogen and oxygen become water, vapor or steam (H_2O). The volume of these gases is much increased by their high temperatures at the moment of combustion.

"The conditions required to bring about a flour explosion are somewhat similar to those which cause a gas explosion. Coal gas is combustible and not explosive when unmixed with air, and it only becomes explosive when it is mixed with sufficient air to burn it. This proportion is obtained in the most powerful degree when one volume of gas is mingled in ten parts of air. A lesser or larger proportion of air lessens the power of the explosion by causing the gas to burn less quickly, and consequently with less explosive force, and thus tending more to ordinary combustion.

"In order to bring about the explosion it is necessary also that the flour-air mixture be confined within a given space; hence, if the flour be incased in a box with the lid fastened down, and the bellows be brought into play to produce a cloud while a light is introduced, the box will be forced open with a loud explosive noise, and the side be split up, while weights placed on the box are thrown off."

Such is the theory of Professor Macadam, whose eminence as a scientist entitles it to the highest consideration. It is certainly very plausible and has many facts in support of it. —*American Miller.*

HYDROBROMIC ACID.

The success which seems to have followed the experiments with this new remedy warrants the belief that it is destined to assume a permanent place in the Materia Medica.

This acid is a sedative neurotic, and now comes into use as an occasional substitute or alternate for the bromides of potassium, sodium, and ammonium, when the influence of bromine, the active medicinal agent of these salts, is sought.

The well known fact that these alkaline bases, and especially potassium, when given for a long time are liable to enfeeble muscular tissues and produce other undesirable changes through undue alkalinity of the blood, is a sufficient reason for seeking a substitute which shall be free from these defects, without suspending the action of bromine, the continuous sedative action of which is often very important. It should be understood, however, that this remedy is not well adapted for prolonged use, for, like the other mineral acids, it would be likely to interfere fully as much with the animal economy as the alkaline bromine salts; it must, for the present, be regarded simply as an alternate for the latter rather than for general use. In hospitals for the insane, especially in epileptic wards, it will be found very useful both in effect and ease of administration, since it can be given in the form of a lemonade, if moderate or small doses should prove effective. It has been highly spoken of as a corrective and preventive remedy for the headache, ringing of the ears, and the general cerebral distress which often follows on the use of salts of quinine. Another important application of this remedy will be found in its occasional substitution for the salines in chronic affections of the nervous systems, where, from long continued use, the patient has acquired a disgust for the alkaline bromides.

Hydrobromic acid—which is really hydrogen bromide—is a gaseous substance containing 98·76 per cent of bromine. The solution of the gas in water, which constitutes the liquid commonly known as hydrobromic acid, is limpid, colorless, and odorless, and has a strongly acid taste. As the strength of the liquid depends on the quantity of gas held in solution it is difficult to state the proper dose without knowing the formula used by each manufacturer, no fixed standard of strength having yet been agreed upon. Dr. Squibb, in a valuable paper on the subject read before the Medical Society of the State of New York, proposes a formula and process for making the acid of a definite strength; and this process being simple and easy, and as good as any that can be devised, will probably be adopted.

The Belcher Springs.

One of the attractions of St. Louis, and where flocks of people go for health, is the Artesian well, known as the Belcher Springs, on O'Fallon street, by the Belcher Sugar Refinery. This well is one of the most noted in the United States, and owes its existence entirely to Mr. William H. Belcher of St. Louis. An interesting account of its boring is given by A. Litton, M. D., in the *Transactions of the Academy of Science of St. Louis.* The boring of this well was begun from the bottom of an old well, 30 feet deep, in the spring of 1849, and the work was stopped in the spring of 1854. The bore to the depth of 219 feet was 9 inches in diameter, then 5½ inches for 731 feet further, and continued at 3½ inches till the full depth of 2,199 feet was reached. At 550 feet, the top of a limestone layer, the water became salty; 200 feet below this, in a layer of shale, it contained 1⅞ per cent of salt; and at 965 feet, below a bed of bituminous marl, 2½ per cent. At the depth of 1,179 feet the hardest rock was encountered, being a bed of chert 62 feet thick. The water is discharged through a 20 inch pipe at the rate of 75 gallons a minute. It is used for medicinal purposes, having a strong odor of sulphureted hydrogen, and contains over 8 per cent of mineral matter, including 6 per cent of salt. Its temperature is even at about 73° Fah. The total cost of the work exceeded $10,000, and is located within the premises of the Belcher Sugar Refinery, and is called "Belcher Water." It is free to all comers.—*St. Louis Review.*

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Drawings and Engravings of Machinery a specialty. Pemberton & Scott, draughtsmen, 37 Park Row, Room 30.

Assays of Ores, Analyses of Minerals, Waters, Commercial Articles, etc. Technical formulæ and processes. Laboratory, 33 Park Row, N. Y. Fuller & Stillman.

Manufacturers of Clamps or Claws for Sleeve and Hose Supports, send samples and prices to A. P. Smith, Rock Falls, Ill.

The Amateur Telegrapher's Text-Book, containing complete instructions in private Telegraph or Telephone Line building: also, illustrations showing the different parts of Morse Instruments and Telephones, with full instructions for making them. Jerome Redding & Co., 30 Hanover St., Boston, Mass.

Special Planers for Jointing and Surfacing, Band and Scroll Saws, Universal Wood-workers, etc., manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

For Sale.—Letters Patent for Self-measuring Fluid Tank, or improvement in liquid measures; best in the market; cheap for cash. Address Box 143, Geddes, N.Y.

North's Universal Lathe Dog. 347 N. 4th St., Phila. Pa.

Wanted.—A first-class Engine of 200 to 250 Horse Power, to be cheap for cash. Address J. M. Hannahs, 97 Maiden Lane, New York.

For Mill Gearing, Shafting, Pulleys, and Hangers, address T. B. Wood & Co., Manufs. Chambersburg, Pa., for price.

Wrought Iron, while Forging, made capable of being Hardened. Box 370, Terre Haute, Ind.

Adjustable Steam Gauge.—The whole Patent or Rights for sale, or would arrange with parties to Manufacture. It can be tested by common spring scale, and adjusted by turning screw; cannot freeze up or get full of dirt. Address Fred McIntosh, Atlantic, Cass Co., Iowa.

Manufacturers of Flying Horses, etc., etc., please send catalogue and price lists to Box 19, Donaldsonville, La.

Steam Yacht "Hiawatha" for sale.—Length, 40 ft.; beam, 8 ft. 5 in.; engine, 12 H. P.; speed, 12 miles. For particulars apply to J. M. Meredith, Exr., Maiden Creek P. O., Berks Co., Pa.

24 inch Second-hand Planer, and 12 inch Jointer, or Buzz Planer, both in first-class order, for sale by Bentel, Margedant & Co., Hamilton, Ohio.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N.H.

Wrenches.—The Lipsey "Reliable" is strongest and best. Six inch sample by mail 60 cents. Roper Caloric Engine Manufacturing Co., 91 Washington St., N. Y.

Cornice Brakes. J.M. Robinson & Co., Cincinnati, O.

Friction Clutches warranted to drive Circular Log Saws direct on the arbor, and Upright Mill Spindles, which can be stopped instantly; Safety Elevators, and Hoisting Machinery. D. Frisbie & Co., New Haven, Ct.

Union Eyelet Company, Providence, R. I., Manufacturers of Patented Novelties on royalty or otherwise.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See ad. back page.

Painters' Rapid Graining Process. J.J.Callow, Clev'd, O.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel — other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood-working machinery, address B.C. Machinery Co., Battle Creek, Mich.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

Chester Steel Castings Co. make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 286.

Lansdell & Leng's Lever and Cam Gate Valves. Cheapest and best. Leng & Ogden, 212 Pearl St., N.Y.

For Best Insulated Telegraph Wire, Telephone Wire, and Flexible Cordage, Eugene F. Phillips, 67 Stewart St., Providence, R. I. W. H. Sawyer, Electrician and Supt.

The Turbine Wheel made by Risdon & Co., Mt. Holly, N. J., gave the best results at Centennial test.

Vertical & Yacht Engines. N.W.Twiss, New Haven, Ct.

Vertical Scientific Grain Mills. A.W.Straub & Co., Phila.

Dead Pulleys, that stop the running of Loose Pulleys and Belts, taking the strain from Line Shaft when Machine is not in use. Taper Sleeve Pulley Works, Erie, Pa.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Water Wheels, increased power. O.J.Bollinger, York, Pa.

NEW BOOKS AND PUBLICATIONS.

SYNOPSIS OF DECISIONS OF THE TREASURY DEPARTMENT FOR 1877. Government Printing Office, Washington.

This is a handy compilation for reference, containing the more important recent decisions of the Department in regard to the construction of the tariff, navigation, and other laws.

HINTS TO PLUMBERS AND HOUSEHOLDERS. By W. L. D. O'Grady. American News Co., New York.

A useful little pamphlet, containing many serviceable hints, especially in regard to precautions against sewer gas. Illustrated with descriptive plates.

SPECIFICATIONS FOR FRAME HOUSES. Palliser, Palliser & Co., Architects, Bridgeport, Conn.

A form for use in making contracts for building frame houses costing from $500 to $15,000, being complete and practical specifications covering all essential points. Blank spaces are left for details which change with the difference in class and cost of houses, such as sizes of timber and parts not shown on plans. Messrs. Palliser, Palliser & Co. have done the public, and mechanics especially, a great service in preparing these specifications, which obviate a great deal of writing and tend to prevent errors by making all the points perfectly clear.

Notes & Queries

C. C.—Please send address.—"Curious."—Consult "Science Record" for 1874, p. 390.—C. E. P.—If we correctly understand your question, we do not know of such a device.—L. A. G.—See SCIENTIFIC AMERICAN, p. 203 (26) vol. 35, and pp. 91 (33), 267 (17); also article on p. 1326, SUPPLEMENT No. 83.—A. W.—Recipes for writing inks may be found on pp. 250 (4), and 219 (18) current volume of the SCIENTIFIC AMERICAN; also on pp. 75 (54), 123 (15), 327, 299 (18), 124 (49), 300 (61), vol. 37. Recipe for a good mucilage is given on p. 283 (38) vol. 37.—N. C. L.—Your metal was probably not made hot enough.—C. A. S.—We think you can do all that is required with ordinary powder by making the holes deep enough.—W. O. C.—See SUPPLEMENTS Nos. 46, 47, 48, and 50, for descriptions of spring motors.—W. F. C. S.—By taking the logarithm of the quantity, and multiplying it by the exponent (3·6 or 1·7, as the case may be), the result is the logarithm of the quantity raised to the required power. The other example referred to is perhaps a misprint, and may be intended for a coefficient. If you will send a copy of the paragraph, it may be plainer.—L. R. C.—Such tools as you describe have been tried. They do not appear to be in general use.—J. W. B.—See answer 67, p. 251, SCIENTIFIC AMERICAN, April 20, 1878.—F. H. W.—You should obtain a specification of the patent.

(1) W. A. asks whether common seashore sand can be utilized for building purposes. A. Generally it cannot; it presents surfaces too smooth and pebble-like to hold well.

(2) J. E. T. asks: How can cracks in hard finished walls and ceilings be filled? A. Use plaster of Paris mixed with a strong solution of alum.

(3) W. H. S. asks: 1. What is the best steel for magnets? A. That will depend somewhat on the style of magnet that is to be made. For permanent horseshoe magnets, the German spring steel is generally preferred. 2. To what degree should it be tempered? A. Leave it hard. 3. Is there a practical treatise on magnetism? A. Consult Miller's "Electricity and Magnetism."

(4) C. E. H. writes: In Porter's book on the "Indicator," p. 213, it is stated that "a horizontal engine is perfectly balanced in the horizontal direction by a counterweight equal in weight to the entire mass of the reciprocating parts, revolving opposite to the crank, and having its center of gravity at a distance from the center equal to the length of the crank." Is the same true, in a vertical direction, of an inverted vertical engine, such as is used in most tow boats, and would such an engine so constructed be free from lateral vibration? A. The effect of this mode of counterbalancing is to produce the greatest strain at about the half-centers, where it is resisted by the rigidity of the frame and foundation.

(5) W. R. A. asks: Will increasing the number of check valves between a pump and boiler decrease the strain on said pump; that is, will a pump work any easier with two or three check valves than with only one? A. Quite the contrary, in general, we think.

(6) E. B. S. asks: 1. What is an aneroid barometer? A. It is a metallic barometer, in which the pressure is received on the sides of a thin metallic box, from which the air is partially exhausted. 2. Is it as good as a mercurial barometer? A. It is not so reliable for permanent use without readjustment as a good mercurial barometer.

(7) M. C. asks: What is the average diameter of the propeller wheel used by the National, Cunard, Inman, Anchor, and other ocean steamers? A. It varies greatly in different steamers. A fair range will be from 19 to 23 feet.

Will it require more force to fill a 5 foot tank by forcing water into the bottom than over the top? A. Ordinarily, no.

How far will a ball go, shot from a cannon on the rear end of a railroad train, going at a velocity of 60 miles per hour, the cannon fired in an opposite direction? A. See p. 273, vol. 32.

What is the best acid to use on a steam fire engine for cleaning brass, copper, German silver, and nickel plate? A. You can use oil of vitriol diluted with water for the brass. Ordinarily, no acid is required for the other metals.

(8) In answer to R. A., who is troubled with a rusting boiler: By feeding into the boiler, every morning, a whitewash of lime and water, until a light scale is formed, we think you can prevent further corrosion.

(9) G. W. T. asks: Which part of a buggy wheel runs the fastest, the bottom or the top? A. The top moves the fastest, considering the motion with reference to some fixed point without the vehicle, because each point in the periphery of the wheel describes a cycloid.

(10) H. E. W. asks: How do manufacturers of the buttons for hotel annunciators, etc., cut the thread on the button to screw on the cap? A. It is done in a lathe, with a "chaser."

(11) W. H., Jr., writes: I am thinking of building a small propeller, and an engineering friend of mine advised me to use a rotary pump for the engine. How would it work, and how much power could I realize? Could I drive a boat 20 feet long, 5 feet beam, at a good speed in this way? A. Rotary pumps or engines can be used for such a purpose as ordinarily built. Such an engine would require a boiler capable of furnishing about twice as much steam as would be needed for a well designed reciprocating engine developing the same power.

(12) S. T. M. asks: 1. What causes the hair to become prematurely gray? A. A chemical change, not thoroughly understood, which affects the oily pigmentary matter. The change is not necessarily a sign of loss of vitality, as gray hair often grows as vigorously as any other. 2. Is there any remedy? A. None that is reliable. It is thought, however, best not to wear close fitting and unyielding hats, which also tend to produce baldness. 3. Would having the hair cut close be beneficial? A. It sometimes adds to the vigor of the growth, but would probably not affect the deposition of coloring matter.

(13) A. D. asks: What is fire damp, and how does it originate? A. Fire damp, also called marsh gas, or light carbureted hydrogen, is composed of carbon and hydrogen in the proportion of one atom of the former to four of the latter (CH_4), or carbon 75 per cent and hydrogen 25 per cent. It is generated by the decomposition of coal, and is frequent in bituminous mines, often producing terrible explosions. The mixture of air to produce an explosion may be from 7 to 14 times that of the gas.

(14) C. C. asks: How can I stain the white portions of black walnut so as to correspond with the rest of the wood? A. Use a moderately strong aqueous solution of potassium permanganate.

(15) R. T. N. asks: How large an engine will it take to run a common rowboat? A. For an ordinary Whitehall rowboat, 18 feet long, to run at a speed of 8 miles an hour, the engine should have two cylinders, 2 inches diameter and 3 inches stroke; tubular boiler 24 to 28 inches in diameter, 4 feet high, propeller 22 to 24 inches in diameter, with 3 feet pitch.

(16) M. J. asks: 1. Can more than two telephones be used on one circuit? A. Yes. 2. Must they be at the terminus? A. No. 3. In transmitting music can a chorus be heard as clearly and distinctly as a solo? A. No.

(17) G. A. W. asks: How can I form an earth connection for a telephone where there are no gas or water pipes to attach the wire to? A. Bury a quantity of scrap tin or iron, through which is laid 20 or 30 feet of naked copper wire, of about No. 8 gauge. On this metal heap sprinkle 10 or 12 lbs. of common table salt, and cover the whole with earth, but leave one end of the copper wire projecting above the surface. The metal should be buried in moist earth, at whatever distance that may be below the surface.

(18) S. J. K. asks: 1. How can I put up a dry battery (in sand)? A. Make a watertight box, of about 1 cubic foot capacity, out of sheet lead $\frac{1}{16}$ of an inch thick, and nearly fill it with clean white sand moistened with a solution of sulphate of copper. The lead box forms the positive pole of the battery, and a plate of zinc buried in the sand forms the negative pole. 2. Is there any preparation into which the wax moulds, used in electrotyping, can be dipped, to substitute the use of plumbago? A. See answer 28, p. 250, of SCIENTIFIC AMERICAN, of April 21, 1877; p. 177, September 22, 1877; and p. 284, answer 48, November 3, 1877.

(19) C. B. W. asks: Cannot a helix be formed by winding the uncovered wire in the first layer with the different coils separated by the thickness of the wire, giving the helix the appearance of a screw; then covering the first layer with a piece of silk or cotton and winding the second layer, each coil occupying the groove left in the preceding layer, and so forcing the silk between the wires, and so of successive layers? A. Yes, but it is awkward to properly connect the ends of each layer of wire.

How can a rail be 1 foot out of balance when its support is only ½ foot from the center of length? A. Regard the rail as a lever in which the weight of one arm is balanced by the weight of the other arm; when it is moved as you mention, one arm is made 6 inches shorter and the other 6 inches longer than it was when balanced; the relative difference is 1 foot.

With what can paper collars be made waterproof? A. Float each sheet of paper in succession in a bath of albumen, and hang up each sheet to dry; then coagulate the albumen by floating each albumenized sheet in a bath of hot water.

(20) F. R. R. asks: Which way will an Artesian casing stand the greater hydraulic pressure without bursting or collapsing, from the inside out or from the outside in? A. The casing will withstand the greatest internal pressure, because it is shown, both by experiment and theory, that when exposed to internal pressure the strength varies inversely as the diameter and thickness; while for an external pressure the strength decreases more rapidly as the thickness decreases, and also as the length increases. You will find the matter discussed in Rankine's "Treatise on the Steam Engine."

(21) E. W. D. asks: 1. If I make a telephone with a soft iron core and use a battery, will it infringe on Mr. Bell's patent? A. That will depend on other circumstances. 2. The other day, when it was damp, we worked telephones 70 miles very successfully; since, in clear and dry weather, we could only get indistinct sounds from the same distance and over the same wire. What is the reason? A. It may be owing to loose joints in the main line, which in wet weather become filled with water, so that then the conductivity of the line becomes more uniform throughout its length.

(22) W. U. asks: Is there any positive proof that there is a resisting medium in space? A. Not by any physical tests. See answer to P. L. W., page 250, SCIENTIFIC AMERICAN, April 20, 1878.

Is the earth's orbit approaching a circle? A. From observations made at distant periods it has been discovered that the eccentricity is subject to a continual slow diminution. The amount of the diminution of the greatest equation of the center (the measure of eccentricity) is placed at 17·6″ in a century.

Will two bodies in space falling together under the influence of mutual attraction move toward each other in straight lines, or will they tend to describe a conic section about one another? A. On the assumption that there were no other matter in space and no interfering force they would approach in a straight line, in accordance with Newton's first law. Consult Maxwell's "Matter and Motion" and Norton's "Astronomy."

(23) J. C. M. asks: 1. If two steam gauges are put on a boiler, one at the top, the other at the bottom, how much more will the bottom one show? A. The difference due to the pressure of the water above it. 2. What is the temperature of the water in a boiler when there is 60 pounds of steam to the square inch? Does the temperature of the water rise with the steam? A. The temperature of the water is generally about the same as that of the steam; in this case about 277°. 3. What difference in the working of an engine does it make when the areas of the exhaust and supply pipes are the same? A. None, ordinarily. 4. Can any harm arise from carrying your boiler full of water, say two inches from the top of an upright tubular boiler? A. If the boiler will furnish dry steam under such circumstances, we do not think there is any harm done.

(24) N. H. D. writes: I wish to make an electro-magnet capable of sustaining from 100 pounds to 125 pounds weight. Please advise me. A. To form the core bend a piece of soft, round iron, one inch in diameter and two feet long, into the form of the letter U; on each of its arms slip a spool or coil of insulated wire, three inches in diameter and about eight inches long, formed by winding No. 16 copper wire, cotton insulation, on a mandrel or shaft of round iron, one inch in diameter and one foot long, wrapped with four layers of foolscap paper. As each layer of insulated wire is wound on the mandrel it should be brushed over with hot glue, and when the spool is thus wound, and the glue between each layer of wire is thoroughly dry, then the mandrel is knocked out of the spool. Wind each spool in the same direction, and when the spools are slipped on the core, connect the inside end of one spool of wire with the inside end of the other spool of wire; this will leave two ends of wire, which are to be connected with the poles of a battery of five of Grove's cells.

(25) H. F. H. asks: What is the rule to find how many square feet of heating surface is necessary to warm a greenhouse? Hot water pipes are used. Would it require more than if for an ordinary room? Is any allowance made for double sashes? A. Where double sashes are used, the heating surface furnished for an ordinary apartment will be sufficient; but for single sashes the heating surfaces can be made twice as great, to advantage.

Which is the most paying trade, carpentry or cabinet making? A. If a cabinet maker is a man of good taste and with some knowledge of design, his trade is generally more remunerative than that of the carpenter; or this is generally true, at least, in a community where taste is a merchantable commodity.

(26) E. M. C. asks: Other things remaining the same, would the horse power of an engine increase and decrease in direct proportion with the length of the cylinder? A. Yes.

What are the standard average wages of machinists and coppersmiths? A. There is no standard. Machinists earn from $2 to $3 per day, and good coppersmiths from $3 to $4.

Please state the dimensions of one of the first class ocean steamers. A. The Britannic is 467 feet 2 inches long, 44 feet 2 inches beam, 33 feet 7 inches depth, and measures 5,004 tons.

(27) S. H. P. asks: Who was the inventor of the mariner's compass? A. It is uncertain. The invention is sometimes ascribed to Flavio Melfi, or Flavio Gioja, a Neapolitan, about the year 1302. Some authorities assert that it was brought from China by Marco Paolo, a Venetian, in 1260. The invention is also claimed by both the French and English.

Is there any heavier metal than platinum known? A. No. Iridium and osmium have nearly as great density.

At what degree of heat is common illuminating gas ignited? A. According to Draper it requires a temperature of little less than 1000° Fah.

(28) S. L. P. writes: Suppose an upright steam pipe closed at the top, and live steam admitted at the bottom, would the condensed steam be held at the top of the pipe, or would it drip back as fast as condensed? A. The water would be at the bottom.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

D. F. R.—The doloritic rock contains much iron and a little titanium. It does not contain silver or other valuable metal.—L. N. G.—Gneiss rock containing marcasite—a sulphide of iron.—T. J. H.—Larger specimen contains crystals of franklinite (zinc-manganese-iron oxide). Zincite—red oxide of zinc and feldspar. The smaller sample is metallic antimony with a trace of bismuth.—N. G.—The schistose rock contains sulphide of iron.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Patent Court. By A. W. S.
Amendment of the Patent Laws. By C. S.
Arctic Expeditions. By J. S.
Are the Seasons Growing Colder? By L. S.
Astronomical Discrepancies. By L. S. B.
Cinders in the Eye. By J. H.
Nebular Hypothesis. By S. M.
Notes on the Telephone. By L. L. D.

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INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 26, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Aging liquors, P. E. Jay 201,679
Axle box, car, I. R. Titus 201,851
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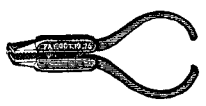

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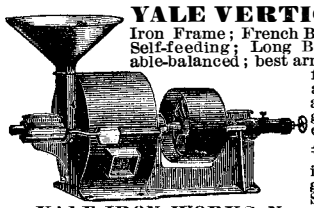

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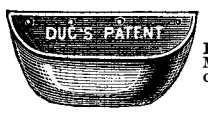

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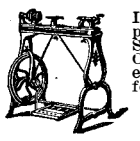

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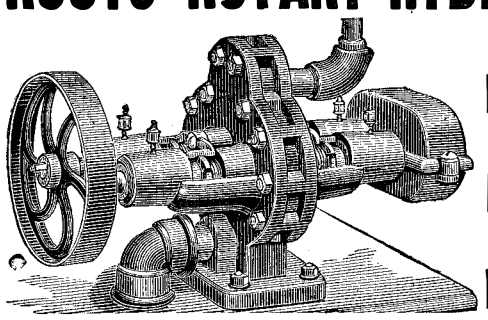

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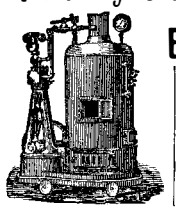

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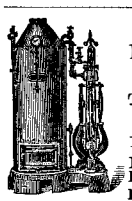

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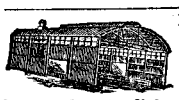

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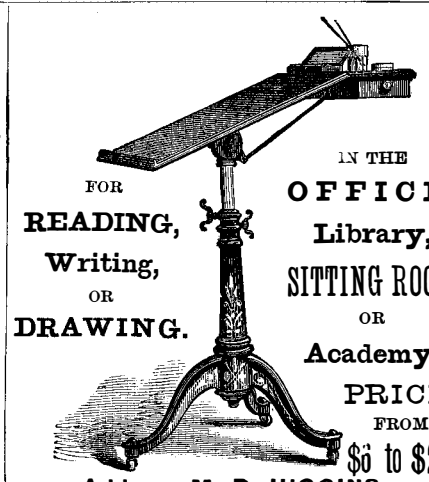

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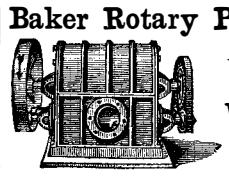

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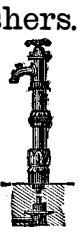

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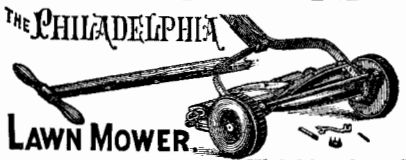
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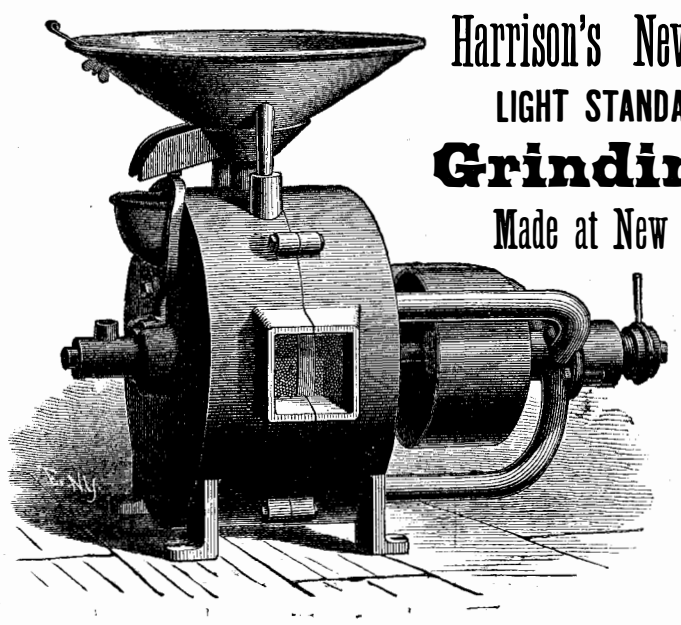

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